ENVIRONMENTAL GUIDELINES FOR POULTRY PRODUCERS In British Columbia

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Ministry of Agriculture, Fisheries and Food

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PREFACE

THE POULTRY INDUSTRY AND THE ENVIRONMENT

With the realization that our environment is becoming polluted from our many activities throughout the Province, the need for change is evident. Farming is one activity that needs to be reviewed to ensure that everyday farm management practices are in harmony with the environment. Perhaps some farm practices that have been used for many years, when evaluated today, may not necessarily be the best for the environment.

Farming is dependent upon the environment and maximizes the use of the soil, water, air and sunlight for agricultural production. While the farmers have the need to "manage" the environment to sustain their production, their management practices have the potential to affect the environment in a positive or negative way.

Major management concerns in the poultry industry in B.C. include the handling and use of poultry manure in the environment. Poultry manures are a valuable source of plant nutrients and organic matter for plant production, but incorrectly managed, these same valuable plant nutrients can be detrimental to the environment. Incorrect storage and excess application of poultry manure can result in the pollution of water by the leaching of nutrients through the soil into groundwater and the runoff of manure into surface waters.

Farm management practices must be conducted in an environmentally sound manner, so it is with a strong awareness of the sensitivity of the environment that these guidelines have been written. They are intended to ensure that not only a sustainable environment for agricultural production continues, but also that a suitable environment for others is achieved.

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SECTION 1 INTRODUCTION

Agricultural production in British Columbia is very diverse. However, a common thread throughout agriculture is the need to use and sustain the land and water resource for crop and animal production. Therefore, the sustainability of the agricultural industry is dependent upon farms operating under environmentally sound agricultural practices that protect this resource base. Several Federal and Provincial environmental laws and regulations also exist to ensure the land and water resource is protected from unacceptable farming practices.

In order to supply all the poultry products required for the B.C. market at a profitable and efficient level, the poultry industry relies on using the resource base under intensive production systems. The use of intensive production systems, for the production of eggs and meat, coupled with the sensitivity of the receiving environment makes operating in an environmentally sustainable manner a challenge.

Coincident with the intensification of poultry production facilities over the past years has been an increase in the number of residential dwellings on or near farmland. Unfortunately, this has often resulted in neighbours making unwarranted complaints against farmers who are using generally accepted farming practices. In order to protect the farmer from such complaints, the Agriculture Protection Act was enacted. This Act provides protection to the farmer providing the farm is operated under "generally accepted farming practices" and is in compliance with applicable legislation. The Code of Agricultural Practice for Waste Management, under the Waste Management Act establishes standards for generally accepted and environmentally sound agricultural practices.

The purpose of these guidelines is not only to support the above legislation, but to offer the poultry industry various options for managing their farms in an environmentally sound manner without contravening any of the existing Federal or Provincial environmental laws or regulations. However, it is recognized that because of regional or local differences, not all portions of the guidelines need apply to every poultry producer. In certain situations, other management options not addressed in these guidelines may be necessary to be implemented on the farm to prevent pollution from occurring. It is the responsibility of the individual farmer to consider other management options, as well as these guidelines, to prevent pollution. These other options should be reviewed by a professional qualified in environmental assessment before being implemented.

Information presented in these guidelines is based on the best available research data and years of experience. New and better farm practices and methods will be developed and periodic revisions of the guidelines will be required. Individuals not trained or experienced in poultry farming practices should not extract portions of the guidelines, nor draw inference, without considering all aspects of the problem. These guidelines should not be adopted literally into legislation, in whole or in part, by any level of government.

Although these guidelines have been developed with the cooperation of the B.C. Federation of Agriculture and member organizations, these guidelines apply to any poultry farm in British Columbia whether or not there is any affiliation with the B.C. Federation of Agriculture.

Some of the information contained in these guidelines is applicable to rearing game birds, ducks, geese or exotic species. For more information see Gamebird Environmental Guidelines.

SECTION 2 REGULATIONS AFFECTING B.C. POULTRY PRODUCERS

Federal, Provincial and Local levels of government can establish environmental legislative requirements. Each of these have jurisdiction over poultry producers in some manner that legislates the prevention of pollution or nuisance. Compliance with one agency does not necessarily mean that requirements are satisfied for all agencies. Non-compliance with the legislation or regulation of any agency can result in fines, jail terms or regulated compliance, such as the requirement to have a permit to operate.

There are also several non-regulatory programs in British Columbia that support the farmer in meeting the legislative requirements of the various governments. These programs also encourage the implementation of generally accepted farm practices for the protection of the environment. Programs under the B.C. Ministry of Agriculture, Fisheries and Food explained in Appendix A include: Best Agricultural Waste Management Plans, Best Soil Management Plans, Agricultural Land Development Assistance (ALDA) and the Manure Management Computer Model. The Agricultural Environmental Protection Council under the B.C. Federation of Agriculture is explained in Appendix B.

2.1 LOCAL GOVERNMENT

Local governments have the authority to enact and enforce a variety of land use plans and zoning bylaws that affect agricultural operations. Most local government's legislation relating to agriculture are zoning bylaws that can zone particular areas for agriculture within their regions or districts, along with establishing specific setbacks for the siting of farm buildings. Specific setback distances from lot lines and watercourses are to help reduce neighbouring conflicts and the occurrence of pollution.

Local government's authority to establish legislation affecting agriculture is given under the Municipal Act; however, all municipal planning within the Agricultural Land Reserve is subject to the Agricultural Land Commission Act.

In the event that changes are made to a zoning bylaw, existing poultry farms not in compliance with the new bylaw will be protected under the non-conforming section of the Municipal Act. This means that the poultry farm would be considered "legally non-conforming" and could operate as normal but limited to the existing size unless expansion can meet the requirements of the new bylaw.

Each local government varies in the number of bylaws that they have affecting agriculture. Local government legislation can regulate:

- specific areas within a region or municipality where poultry production is permitted,
- specific setback distances from lot lines for farm buildings,
- building requirements in flood plains,
- nuisance e.g. excessive noise from farm machinery, and
- setback distances of farm facilities to watercourses.

2.2 PROVINCIAL GOVERNMENT

There are five Provincial Government Ministries in British Columbia that administer Acts that impact farm practices on British Columbia poultry farms. When provincial and federal acts or regulations change, producers must meet the changes as there is no "non-conforming status" as in local government legislation. The environmental guidelines are written taking into account the requirements specified in the following Acts or regulations.

2.2.1 Ministry of Municipal Affairs, Recreation and Culture

Municipal Act: This Act gives local governments the authority to write bylaws that control the use and development of land, including the regulation of poultry operations. Control of land is achieved through community plans, land use bylaws, and development permits. The Municipal Act also gives local government the authority to make bylaws that control nuisance.

2.2.2 Ministry of Health

Health Act: This Act regulates farm practices that may be a health hazard. A health hazard may occur, for example, if manure or ventilation air or other wastes are discharged into land, water or air to such an extent that nutrients or pathogens cause a health problem to the general public. Sanitary regulations also address dead animal disposal and in-barn washroom facilities.

2.2.3 B.C. Ministry of Environment, Lands and Parks

Waste Management Act: This is the major Provincial legislation that is responsible for controlling pollution within the agricultural industry.

Pollution is defined under the Waste Management Act as "the presence in the environment of substances or contaminants that substantially alter or impair the usefulness of the environment."

The Agricultural Waste Control Regulation has been enacted supplemented by a set of farm practice standards called the "Code of Agricultural Practice for Waste Management." A copy of the Agricultural Waste Control Regulation and Code of Agricultural Practice for Waste Management is in Appendix C.

Farmers who carry out an agricultural operation in accordance with the Code of Agricultural Practice for Waste Management are exempt from holding a permit under the Waste Management Act. This does not imply that a farmer is exempt from the requirements of the Act. If agricultural waste is not handled as outlined in the Code of Agricultural Practice for Waste Management, then a Waste Management Permit is required.

The Waste Management Act also contains a regulation that applies to the management of *special wastes* including "waste oil" and "pest control product wastes and containers".

Pesticide Control Act: This Act applies to the sale, transportation, storage, preparation, application and disposal of pesticides. The Ministry of Environment staff investigate complaints of pesticide misuse, advise on and inspect applications, give examinations to certify applicators and dispensers, and inspect premises of pesticide vendor and applicator services to ensure compliance with the Act. A provincial Permit Coordinator at the headquarters's office in Victoria receives applications for Pesticide Use Permits which are required under the Act for pesticide use on public land, or on private land used for forestry, transportation or public utilities.

Farm practices must not cause pollution. The B.C. Ministry of Environment, Lands and Parks can take legal action anytime under the Waste Management Act, and Pesticide Control Act should pollution occur.

2.2.4 Ministry of Agriculture, Fisheries and Food

Agriculture Protection Act: This act protects farmers from the threat of unwarranted nuisance suits. The protection for the farmer against such suits is dependent upon the farm being operated in a "reasonable manner or in accordance with generally accepted farm practices." The farm must also be within the Agricultural Land Reserve and comply with all other relevant legislation and regulations (local, provincial and federal) that relate to the farm practice being challenged in the nuisance suit.

2.2.5 B.C. Ministry of Transportation & Highways

Highways Act: The Highways Act contains a section under "Protection of Highways" that describes any noxious, offensive or filthy water or substance caused to be left on the highway or road as being an unlawful practice. The RCMP or local police will enforce this Act when an infraction occurs.

2.3 FEDERAL GOVERNMENT

Fisheries Act: At the present time, the Fisheries Act is the main Federal Act that addresses pollution from farms. This Act prohibits an unauthorized deposit of a deleterious substance into water frequented by fish or into water that may eventually enter water frequented by fish. Environment Canada in cooperation with Fisheries and Oceans has the lead role in the administration of the pollution control provisions or the Fisheries Act. The Canadian Shellfish Sanitation Program for the monitoring of shellfish water quality is included in the Fisheries Act. Examples of potentially deleterious substances are: manure and runoff from manured areas, woodwaste leachate, pesticides and improperly disposed of mortalities.

SECTION 3 POULTRY BUILDINGS AND EQUIPMENT

This section contains general information on site location, building construction, watering and ventilation systems, and feed processing and storage for poultry operations.

3.1 BUILDING SITES

The importance of good farmstead planning cannot be overemphasized. A little effort spent in carefully selecting a building site can result in eliminating neighbouring conflicts and potential environmental problems (see Figure 3.1). New poultry building sites should be selected after considering the following factors:

- Be aware of local government bylaws and Federal and Provincial requirements.
- Locate within the Agricultural Land Reserve and agriculturally zoned areas.
- Evaluate the land base available (deeded and leased) to ensure sufficient cropland is available to receive agricultural wastes as an organic fertilizer for crop production. For more information, see Section 6, Land Application of Poultry Manure.
- Take advantage of prevailing winds to direct unavoidable production of dust and odours away from neighbours and the farm house.
- Take advantage of natural terrain and landscaping to minimize conflicts with neighbours over such things as excess feathers, dust, and odours. Air turbulence created by shrubs and trees will encourage dilution of odours.
- Locate on an adequately drained site, being careful to avoid low areas subject to flooding.
- Grade the area so as to divert polluted runoff into manure storage and unpolluted runoff water away from the buildings and manure storage areas.
- Service the farm with a compacted, well drained gravel or asphalt roadway.

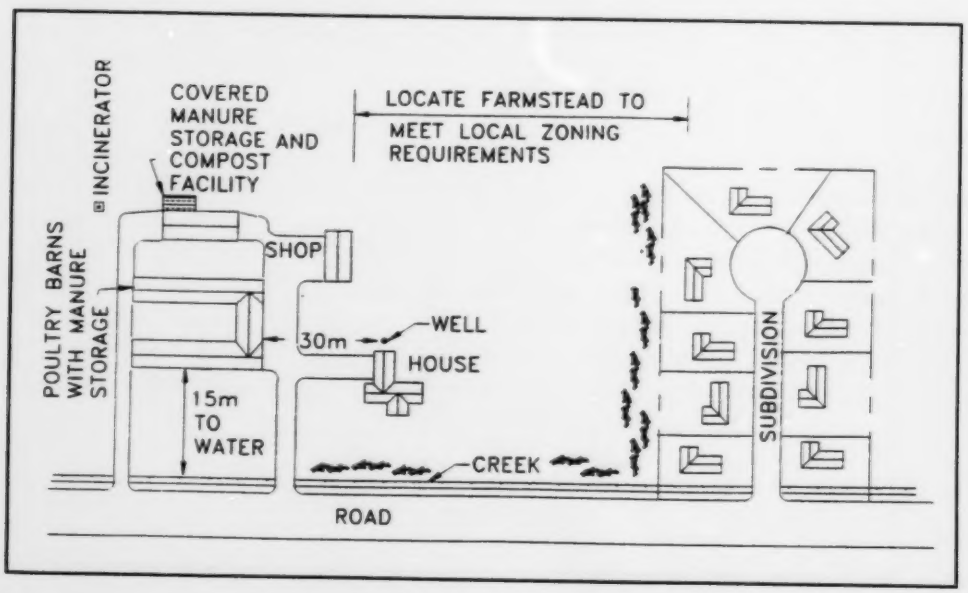


Figure 3.1 Example of a Well Planned Building Site

3.2 HOUSING AND WASTE HANDLING SYSTEMS

Most poultry producers in the province have some form of confined housing and feeding facility, although turkeys may be raised for part of the year in the drier climates on outdoor ranges. Houses for various enterprises, such as turkey, egg or broiler production, may differ greatly in size, appearance and arrangement of facilities. However, a properly located, well-insulated building equipped with proper ventilation, efficient heating and lighting systems and environmentally sound waste handling and storage facilities are important for any type of poultry operation.

Poultry houses should be located on a well drained site of adequate size, not only to serve present needs but also for future expansion. The buildings should be adequately separated to ensure reasonable protection against fire and to allow ventilation around them. Detailed poultry building plans are available from local consultants and contractors. All new poultry buildings should be designed and constructed in accordance with the Canadian Code for Farm Buildings.

Some standard, conceptual, and leaflet plans are available from the B.C. Ministry of Agriculture, Fisheries and Food, Soils and Engineering Branch. Figure 3.2 shows a typical barn wall showing environmentally sound construction.

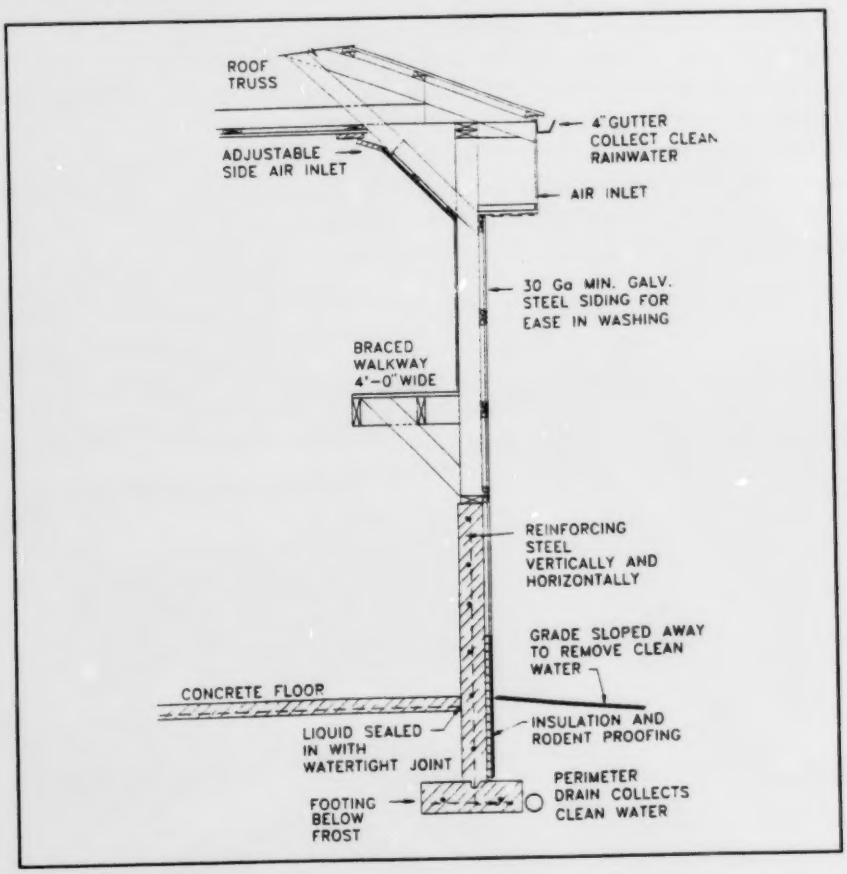

ROOF TRUSS
4" GUTTER COLLECT CLEAN RAINWATER
ADJUSTABLE SIDE AIR INLET
AIR INLET
30 Ga MIN. GALV. STEEL SIDING FOR EASE IN WASHING
BRACED WALKWAY 4'-0" WIDE
REINFORCING STEEL VERTICALLY AND HORIZONTALLY
GRADE SLOPED AWAY TO REMOVE CLEAN WATER
CONCRETE FLOOR
INSULATION AND RODENT PROOFING
LIQUID SEALED IN WITH WATERTIGHT JOINT
PERIMETER DRAIN COLLECTS CLEAN WATER
FOOTING BELOW FROST

Figure 3.2 Poultry Building Construction for a Typical Layer Barn

Every construction project should be well planned. Consideration must be given to all weather road access, drinking water, electric power, barn construction, manure storage facilities and manure utilization. Before construction, obtain the approval of local authorities.

To aid in sanitation and waste disposal, poultry buildings should:

- have concrete foundation walls extending at least 30 cm (1 ft) above the grade line,
- be of tight frame construction to discourage the entry of rodents,
- be kept in a proper state of repair,
- have adequately screened ventilation inlets and outlets to discourage the entry of rodents and birds in mechanically ventilated barns,
- have gravel splash pads at the base of the wall for erosion control where roof runoff occurs, and
- have adequate perimeter drainage to remove roof and surface water away from the building in an uncontaminated state.

Properly planned and equipped agricultural structures can improve worker and animal health, increase production efficiency, and improve product quality.

The types of handling systems commonly involved with each of the various poultry production operations and other pertinent information, are given in the accompanying Table 3.1. Reference material for poultry producers is listed in Appendix E.

Several waste handling systems currently used by British Columbia poultry producers are discussed in the following sections. While there are a number of alternate manure handling methods, all poultry producers are urged to adopt a system in which manure is kept as dry as possible. Drier handling of manure not only minimizes fly and odour problems, but also aids in general sanitation and reduces the volume and weight of manure which must be handled. For this reason, the deep pit system in cage houses, and the use of litter or heated floors in solid floor houses, are recommended for new poultry operations.

3.2.1 Cage Houses, Deep Pit System

The deep pit offers several operational advantages over some of the other systems. For example, a separate manure storage facility is not required. In the deep pit system, manure is allowed to drop into a 1.5 to 3.0 m (5 to 10 ft) deep pit under the cages where the droppings undergo a natural composting drying process, causing a biological degradation of the wastes and a reduction of the weight and volume of manure. If properly operated, a deep pit may not need to be cleaned out for 1 to 3 years depending on the depth of the pit. This is an easy system to manage and only requires a front-end loader and a conventional manure spreader to clean out the deep pit.

Odours and flies are not a problem in the deep pit system so long as the manure in the pit is kept dry. Dry poultry systems should result in manure that has less than 25% water. The deep pit system is effective in controlling flies, partly because the manure storage area is completely closed and dark and the manure is kept dry, and partly because of the natural predators which thrive in the manure compost. The success or failure of the deep pit system depends upon the extent to which excess water can be excluded from the pit. If the manure is wet, the composting process will not occur, resulting in odours, fly problems and the need for frequent cleanouts.

Table 3.1 Poultry Housing and Waste Handling Systems

Poultry Type	Housing System	Recommended Density (m^2/Bird)	Time in Housing System (weeks)	Live Weight Range at End of Housing Period (kg)	Cycles per Year
Pullets	cage floor	0.03 0.14	18 - 19	1.28 - 1.35	2.5
Layers	cage floor range	0.04 0.2 10	51 - 54	1.7 - 1.8	1
Broiler Breeder Pullets	floor	0.19	16 - 17	1.8 - 2.5	2.5
Broiler Breeder Layers and Stags	cage floor	0.06 0.19	43 - 46	3.1 - 5.0	1.2
Broiler Chickens	floor	0.07	6	1.7 - 2.0	5.8
Roaster Chickens	floor	0.17	8	2.3 - 2.7	5.8
Turkey Broilers	floor range	0.19 20	10 - 11	4.5 - 6.2	4
Turkey Large Hen	floor range	0.22 20	13 - 15	6.2 - 9.8	2.5
Turkey Large Tom	floor range	0.20 20	16 - 18	9.8 - 13.5	2.5

To convert to Imperial units: 1 m^2/bird = 10.8 ft^2/bird
1 kg = 2.2 lb

All the following aspects are of extreme importance in the design and management of a successful deep pit system:

All the following aspects are of extreme importance in the design and management of a successful deep pit system:

- The deep pit should be constructed of concrete and be completely sealed to prevent seepage of groundwater into the pit and the escape of contaminents into the environment. In cases where the water table is very high, construction of the deep pit cage house completely aboveground is recommended. This will also simplify the cleanout operation.
- Individual water cups or nipples are recommended. These waterers, as well as the water distribution system, should be checked regularly (weekly minimum, daily preferred) for leaks and malfunctions.
- The exhaust fans in deep pit cage houses should be located so that air is drawn across the droppings in the pit to provide continuous drying of the manure.
- In high density cage houses, manure in the pit may need to be further dried by placing auxiliary fans over the manure in several locations along the pit.
- The deep pit area should be covered with sawdust or shavings after cleanout prior to the housing of a new flock of birds. Where the old manure is very dry at cleanout, this dry material may be spread over the floor in place of the sawdust.
- A concrete slab should be constructed at the end of the building as a manoeuvring area for tractors and manure spreaders during cleanout.

An example of a deep pit cage house is shown in Figure 3.3.

If manure is to be stored, after removal from the deep pit barn, please see Section 5 for information on manure storage methods.

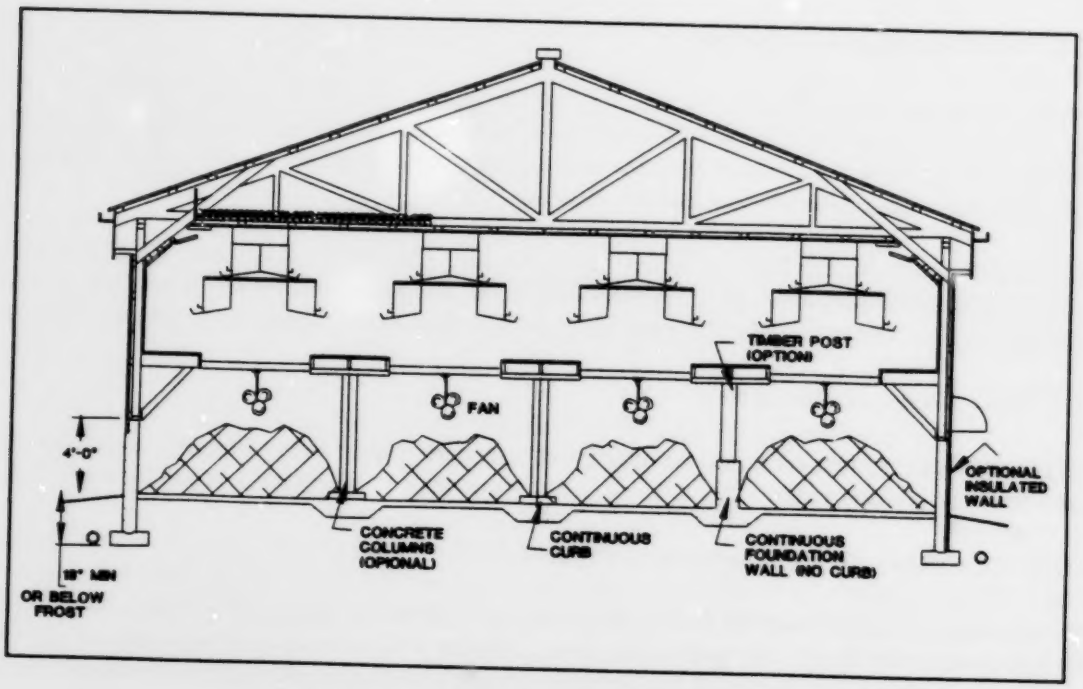


Figure 3.3 Example of a Deep Pit Cage Layer House

3.2.2 Cage Houses, Shallow Pit System

In the shallow pit system, a concrete pit 150 to 200 mm (6 to 8 in) is used to collect the droppings from overhead cages. The manure is allowed to accumulate for a short time, preferably not more than one week, then is scraped into a holding facility with a dragline scraper or a small tractor mounted scraper.

In cases where cleaning on a weekly basis is not practical, the droppings may be allowed to "cone up" under the cages. In this case, provision for additional air circulation at floor level is recommended to dry the manure and reduce odours.

To help control odours and flies in cases where manure is stored for longer than one week, the droppings should be covered periodically with sawdust or shavings. A shallow layer of sawdust or shavings also should be spread over the bottom of the pit between cleanings to facilitate manure removal.

Manure scraped from the shallow pit cage house should be stockpiled in a suitable manure storage structure for disposal at a later time. See Section 5 for more poultry manure storage details.

The shallow pit should be constructed of concrete and be completely sealed to prevent seepage of groundwater into the pit and to prevent the escape of contaminants into the environment.

A concrete slab should be constructed at the end of the building as a manoeuvring area for tractors and spreaders during cleanout.

3.2.3 Cage Houses, Liquid System

Shallow pit systems as described in Section 3.2.2 can be adapted for liquid manure handling. In this case, manure is flushed frequently into a suitable liquid manure holding tank outside the poultry building. The holding tank should have the capacity to store at least six months worth of manure production and flushing liquids required for cleaning.

Liquid handling of poultry manure is not recommended. Probable odours and fly problems, a greater potential for pollution, larger volumes of waste for ultimate disposal, and higher labour requirements all combine to make wet handling of poultry manure unsuitable for poultry production.

3.2.4 Floor Houses, Litter System

Broilers and turkeys often are raised on litter for at least part of their lives. Breeders and pullets are raised on litter in many cases.

In litter type houses, all the following should apply:

- Any clean, absorbent material such as wood shavings, shredded paper products, and sawdust may be used for litter. The litter material should be dry and should not produce excessive amounts of dust. See Section 8.2 regarding Use and Handling of Woodwaste Products.

- The floor should be covered with fresh litter material prior to the housing of a new flock of birds.
- Recommended depth of litter on concrete floors is 40 to 80 mm (1 ½ in to 3 in).
- Litter removed from the building must be stored in a suitable structure. For more detail, see Section 5 on Poultry Manure Storage.
- The floor and at least 300 mm (12 in) of sidewall should be constructed of concrete and be completely sealed to prevent the seepage of groundwater onto the floor and to prevent escape of contaminents into the environment.
- In existing earthen floor turkey barns, a greater amount of litter is required to ensure all liquids are absorbed into the litter. Recommended depth of litter is 600 to 750 mm (24 to 30 in). If the bottom of the litter is moist, it is likely that leachate is escaping and a concrete floor should then be installed.
- A concrete slab should be constructed at the end of the building as a manoeuvring area for tractors and spreaders during cleanout.

An example of a two storey litter floor building is shown in Figure 3.4.

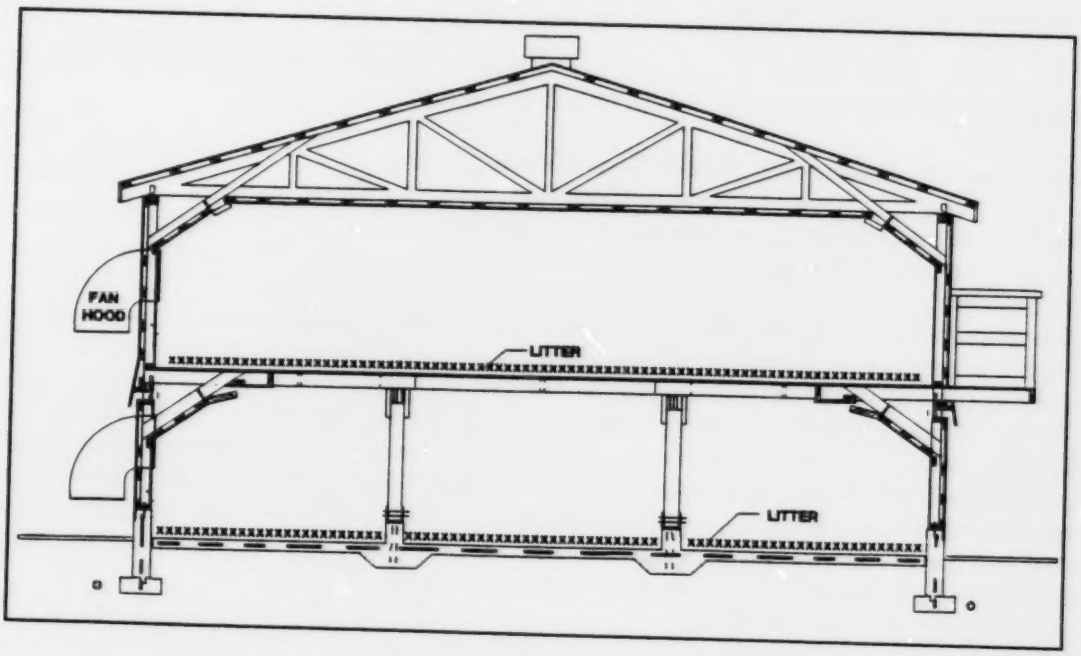


Figure 3.4 Two Storey Building for Rearing Poultry on Litter

3.2.5 Floor Houses, Heated Floor System

Because of the difficulty and expense involved in acquiring good quality litter in some areas of the province, hot water floor heating has been considered as an alternative for poultry growing houses. In this system, hot water at approximately 37 - 50° C (100 - 120° F) is circulated through plastic or steel pipes embedded in the solid concrete floor. By controlling the rate of circulation, the feed water temperature and pipe spacing, the floor temperature can be maintained between 18 and 35° C (65 and 85° F) depending on the age of the birds.

The application of heat to the floor causes the manure to be dried, thereby reducing odours and simplifying manure handling. Manure volume is reduced and it becomes a dry, odourless, and loose material for use as a fertilizer and soil amendment.

Some wet spots may develop occasionally as the birds mature and less heat is applied. In this case, the heat should be left on the floor for a few days after removing the birds.

Manure should be removed from the floor before each new flock of birds is placed in the house. The manure removal operation is simplified compared to conventional litter houses because the material is dry, and because of the obstruction free floor. Generally, only about 40 mm (1½ in) of material will have accumulated after each crop of birds. Because the manure is dry, it may be stored with less odour than encountered with wetter manure from other housing systems. See Section 5 on Poultry Manure Storage, to determine the amount of storage required.

The floor and at least 300 mm (12 in) of sidewall should be constructed of concrete and be completely sealed to prevent the seepage of groundwater onto the floor and to prevent the escape of contaminents into the environment.

At the end of the building, a concrete pad should be provided and sized to accommodate manoeuvring tractors and manure spreaders used for cleanout.

3.2.6 Floor Houses, Partially Slotted Floor System

Partially slotted floors offer some advantages over conventional solid floor litter systems. By placing waterers, feeders and roosts over the slotted portion of the floor, most of the manure is collected in a pit beneath the slots. The litter on the solid portion of the floor remains clean and needs to be replaced less often than would be the case in the solid floor litter system. Up to 12 months manure storage may be provided under the slotted floor. This system is not recommended for new layer operations because of probable odours and fly problems encountered with the wet manure collected in the slotted area. However, partially slotted floor systems are commonly used for breeders and pullets and, at this time, are considered acceptable alternatives for these operations. In cases where the watertable is very high, construction of the partially slotted floor system completely above ground is recommended. This will also simplify the cleanout operation. As with the other systems, the pit should be made of concrete and be completely sealed to prevent seepage of groundwater into the pit and to prevent the escape of contaminents into the environment.

3.2.7 Poultry Ranges

Because of greater potential for pollution, open ranges require more intensive management than conventional poultry operations and are not recommended for high rainfall areas of the province. Poultry ranges are considered a confined livestock area as described in the Code of Agricultural Practice for Waste Management, if manure production exceeded the crop requirement for the manure nutrients. Where used, the following should apply to ranges:

- Locate the range so that all runoff is collected and stored in an environmentally acceptable facility. For more detail, see Section 5 on Poultry Manure Storage.

- Allow at least one hectare of rangeland for every 500 turkeys or 1,000 to 1,200 replacement pullets and young birds (> 8 wks of age), (200 turkeys/ac or 400 to 500 replacement pullets and young birds/ac).
- Move feeders, waterers and shelters as often as necessary to maintain flock health and to prevent the development of wet spots.
- Remove wet manure from the range area as often as necessary to prevent the development of objectionable odours. Spread this manure as an organic fertilizer on cropland, See Section 6, Land Application of Poultry Manure or store as outlined Section 5 on Poultry Manure Storage.
- Cover concentrated areas with sawdust where dust is a problem.
- Divert clean water from roofs and from the surrounding area away from the open yard to prevent mixing with contaminated water within the range.
- Locate the poultry range at least 30 m (100 ft) from a watercourse or domestic water supply.
- Locate manure storage structures at least 15 m (50 ft) from a watercourse, and 30 m (100 ft) from wells used or domestic water intakes.

Figure 3.5 shows a typical poultry range.

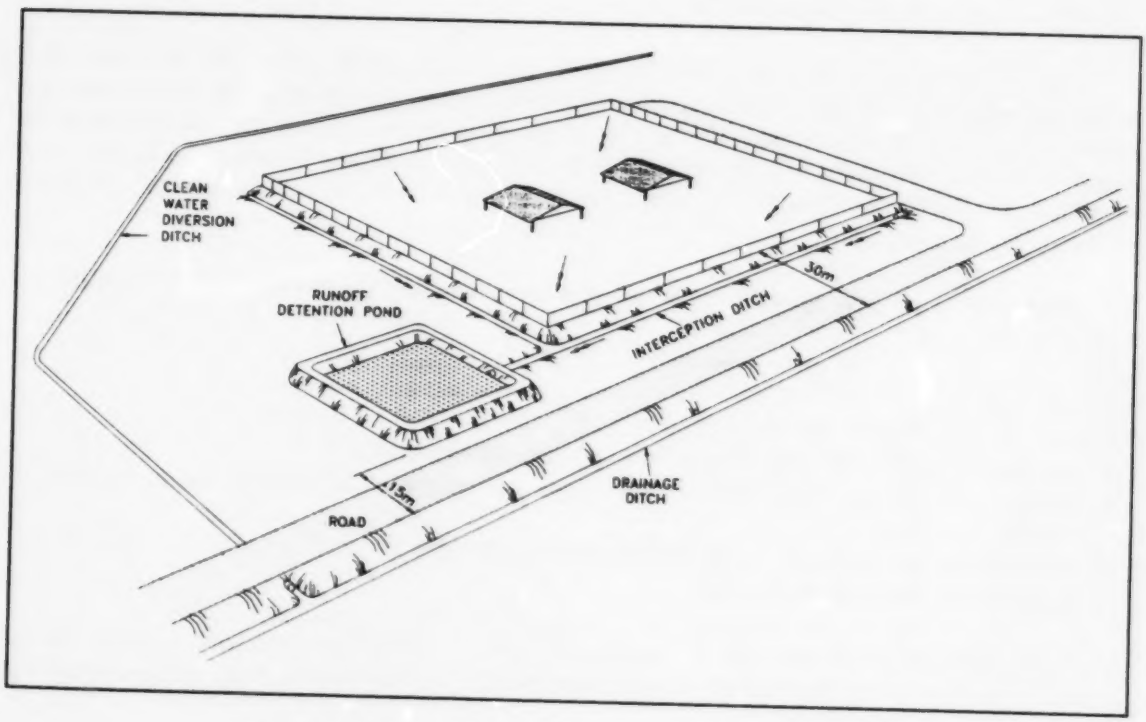


Figure 3.5 Runoff Control Facilities for Poultry Ranges

3.3 WATERING FACILITIES

The odours from dry poultry manure are less offensive than those from moist manure. Furthermore, dry manure is less attractive to flies. For these reasons, water spillage from drinking equipment should be strictly controlled by taking the following steps:

- To reduce the amount of water spillage, waterers should be of individual cup designs or nipples, and be equipped with suitable control valves to provide proper dispensing.
- If water troughs are used, water levels should be maintained at a depth of not more than 12 mm (½ in) or at a depth such that spillage will not occur.
- Water troughs of a continuous flow type are not recommended for service in new poultry buildings. Where such watering devices are being used in existing facilities, they should be equipped with adequate drainage to remove water away from the building in its uncontaminated state. Consideration should be made to replacing these waterers at the earliest convenience.
- All watering devices should be kept in a proper state of repair.

3.4 VENTILATION OF BUILDINGS

A variety of ventilation systems are available. Many plans illustrate the commonly used cross-flow system consisting of manually adjusted, air intake slots on one or both sides of the building and banks of exhaust fans on one side. In the case of the deep pit house, fans may be located in the manure pit area. An ideal system should provide for maximum flexibility between the minimum and maximum ventilation rate. For proper ventilation, buildings must be adequately insulated according to local climatic conditions.

An acceptable ventilation system, under all prevailing weather conditions, should provide the following functions:

- keep litter dry,
- prevent condensation and sweating,
- maintain a suitable and uniform temperature, and prevent drafts,
- provide a rate of air change appropriate to age and weight of the poultry and to outside weather conditions,
- provide fresh air uniformly to all poultry in the building, and
- not cause pollution of outside air.

A standby generator is valuable for maintaining ventilation during electric power failures. In the absence of a generator, construction plans should include insulated panels that can be opened for emergency natural ventilation.

Where possible, to avoid nuisance and pollution conditions, exhaust fans should be located so as to direct their discharge downwind and/or away from nearby residences and public places. To prevent backdrafts, shutters should be installed over exhaust ports. In buildings where dust and odour levels can be high, hoods on exhaust ports to direct the discharge down toward the ground may be beneficial to reduce nuisance and air pollution. In all cases, hoods or protective flaps should be installed on all ventilation ports to prevent the entry of rain and snow.

Ventilation assistance can be obtained through contact with ventilation equipment suppliers and by contacting the B.C. Ministry of Agriculture, Fisheries and Food, Soils and Engineering Branch.

The "Ventilation Handbook" a reference guide for the design of heating and ventilating systems for animal housing is available at the B.C. Ministry of Agriculture, Fisheries and Food, Soils and Engineering Branch in Abbotsford. Figure 3.6 shows the correct installation of a fan complete with shutters and fan hood.

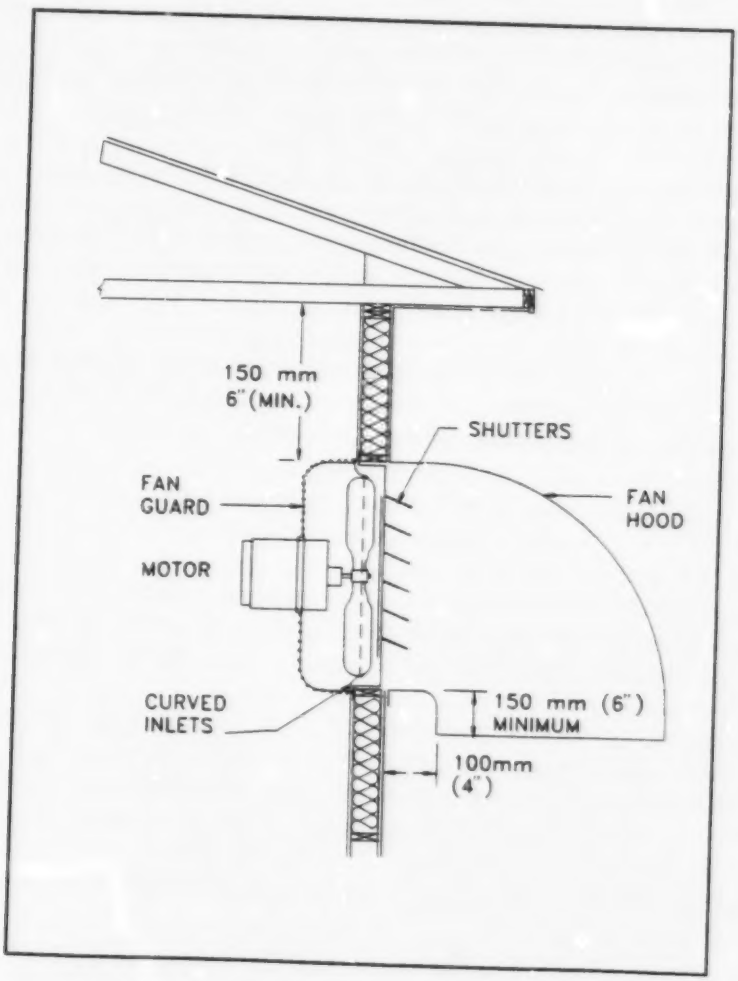


Figure 3.6 Poultry Building Exhaust Fan Installation

3.5 FEED PROCESSING, HANDLING AND STORAGE

Good storage and processing for feed and feed ingredients is a sound investment, whether the material being stored is for use on the farm or for sale. Inadequate facilities and improper management can lead to pollution and substantial losses due to spoilage, insect and rodent damage, and fire from spontaneous combustion.

Before building new feed storage facilities, a complete storage and handling system should be designed to meet both present and future requirements and to consider mechanization.

Choose a building site with good drainage, preferably elevated and easily accessible.

Divert roof water and any other clean water away from the site.

All feed material for processing, processed and stored feed must be contained and not allowed to escape and contaminate surface or groundwater. If there is contaminated runoff, it must be collected and stored in an environmentally sound manner. Contaminated runoff cannot be discharged into a watercourse.

To reduce odours, rodent activity and contaminated runoff, clean up spilled feed as soon as possible.

Consider locating the feed processing and handling centre in an area that will allow space for access of large vehicles. Sufficient setback from neighbours is important due to the increased noise level of operation, dust, traffic and the threat of a fire.

For more information on feed processing, handling and storage, see the publication "Planning Grain-Feed Handling" (MWPS-13), available for viewing at the B.C. Ministry of Agriculture, Fisheries and Food, Soils and Engineering Branch office in Abbotsford.

SECTION 4 POULTRY BUILDING SANITATION

4.1 ODOUR CONTROL

In most cases, odours associated with poultry operations are the result of gases produced from manure and other decomposing organic matter. When manure is decomposed in the presence of sufficient oxygen, termed "aerobic" decomposition, few malodorous gases are produced. On the other hand, the decomposition of manure in the absence of oxygen, termed "anaerobic" decomposition, results in the release of many odorous and sometimes dangerous gases, including ammonia, amines, hydrogen sulphide, mercaptans and methane. Anaerobic conditions occur when wet manure is piled in heaps, or when liquid manure is stored in deep tanks for periods longer than one hour. A good approach to minimizing manure odours therefore is to keep the manure aerobic. Where strong odours are considered a pollutant, a producer could be found in contravention of the Waste Management Act.

There are many alternatives that a poultry producer can implement to minimize problems due to odours. Some of these measures were mentioned throughout the previous sections, but are repeated here to emphasize the importance of good odour control.

- Handle manure in as dry a state as possible. This cannot be over emphasized.
- If manure has to be handled wet, to minimize odours, the wet droppings should be removed from the building frequently and should be stored in closed tanks with minimum disturbance (Note: Poisonous gases can build up in enclosed manure tanks).
- Remove dead birds and broken eggs from the building as soon as possible and promptly dispose of them in an approved manner, as outlined in Section 4.4, Dead Bird Disposal.
- Consider the direction of the prevailing wind before agitating or spreading manure to minimize the possibility of odours and manure particles reaching residences or public places.

As with odour control, suppression of the dust and feathers that can escape the confines of the poultry operation will go a long way in reducing the potential for pollution and complaints. The best strategy in the control of dust and feathers is to clean up in barn accumulations before they become a problem and trap the remaining residues as they leave the barn.

For expanding operations, new operations, or if there is a problem with dust and feathers, consider the following:

- location of exhaust fans
  - direct discharge away from other farm buildings,
  - locate fans so as not to discharge directly onto neighbouring lands,
  - consider direction of prevailing winds.
- fan hoods
  - fans should be equipped with hoods that deflect exhausted air to the ground,
  - ground level foliage should be maintained to trap any dust and feathers that do leave the barn through the exhaust fans.

- dust suppression
    - regular clean up of dust and feather accumulations inside the barn,
    - use clean dust free litter,
    - consider feed that reduces dust formation.
- general sanitation and housekeeping
    - a regular program of washing down both the interior and exterior of barns to remove dust accumulations,
    - maintain fans, hoods and screens on a regular basis to avoid dust buildup,
    - clean up dust accumulations that occur outside exhaust fans to ensure foliage growth remains effective,
    - plant screening shrubs as required outside fan locations to trap dust and feathers, and to cause a greater mixing of exhaust air with outside air to reduce odour levels.

4.2 FLY CONTROL

Excessive flies in the vicinity of poultry buildings and manure storage areas are a nuisance to farm operators and nearby residents alike. Furthermore, flies may transmit disease from one farm to another, and filth and disease from the farm to public places.

A successful fly control program may involve one or more of the following measures:

- Start an ongoing fly control program early in the year.
- Use a handling system that promotes a dry type of manure.
- Regularly remove damp or wet manure and wet feed from the building, and at least once every 10 days during the fly breeding season.
- Prevent scattering of manure and feed outside the building during cleaning operations.
- Dispose of dead birds and broken eggs as soon as possible.
- Store manure in enclosed structures as recommended in Section 5 on Poultry Manure Storage.
- Keep the manure collecting area dark.
- Conduct ongoing fly control measures such as the use of fly cake, insecticidal baits, electronic zappers, or vapona strips.
- Introduce a biological fly control program.

In those cases where a fly problem persists, a qualified pest control officer, or a professional exterminator should be enlisted to conduct a spray program.

4.3 RODENT CONTROL

Rodents such as rats and mice are one of the most widespread and destructive pests in the world. They eat and contaminate vast amounts of food, destroy buildings and spread numerous diseases.

To effectively ward off rodent infestations, constant vigilance is necessary. Rats and mice can be destroyed or controlled only by a vigorous campaign consisting of all of the following:

- rodent proofing buildings
  - screening ventilation ports and other openings in the buildings to exclude rodents.

- eliminating harbourages or nesting sites
  - maintain buildings in good repair.
  - keep the area next to buildings free from weeds, long grass and piles of debris and boards that could harbour rats or mice.
- removing food and water supplies
  - avoid spillage of feed both inside and outside of barns.
  - keep all feeds in covered containers.
  - eliminate water sources such as leaky taps, open water troughs, sweaty pipes and open drains.
- maintaining good sanitation
  - remove dead birds and broken eggs as soon as possible (daily removal is the minimum).
  - keep all garbage in covered containers and eliminate waste and trash.
- poisoning, fumigating and trapping
  - in extreme cases poisoning or fumigating will be necessary to rid the farm of rodents. Poisons, fumigants or rodenticides may be dangerous to humans, pets and livestock. Employment of a professional exterminator is recommended to conduct a thorough program specific to your farm.

4.4 DEAD BIRD DISPOSAL

The following should apply to broken eggs as well as dead poultry of all kinds:

- Dead birds should be removed from the building as soon as possible after death. Dead birds are carriers of disease and, if not promptly removed, will attract rodents and flies and produce offensive odours.
- Dead poultry should be disposed of in an approved manner within one day after death. Where this is not possible, they should be frozen or stored in a covered container for disposal at a more convenient time. Under no circumstances should dead birds be left lying around the farm buildings for an extended period of time.
- Dead birds may be disposed of by delivery to secondary users such as rendering plants, on-farm composting, delivery to local municipal refuse sites (dumps), incineration, or as a last resort in on-farm burial pits.

Dead birds should not be disposed of by dropping them into manure storage areas or by spreading them with manure onto the land.

The disposal of dead birds by open burning is completely unacceptable.

4.4.1 Secondary Users

In British Columbia there are few rendering plants or secondary users that accept dead poultry. For information regarding the closest secondary user to your farm contact your respective poultry association or the office of the B.C. Federation of Agriculture. In those areas where such a facility

exists, daily delivery of mortalities may not be possible. In this case, there may be some additional requirements before delivery of dead poultry occurs such as air tight containers or freezers in which to store dead poultry.

4.4.2 Composting

Composting dead poultry is becoming more popular and, as local experience is gained, it is anticipated that a variety of on farm composting facilities will be constructed. Some basic requirements for carcass composting are that:

- An aerobic environment must be maintained.
- All material must be heated throughout to a temperature of 55° C (130° F) for at least three days for adequate reduction of pathogen levels.
- The structure should consist of a concrete pad, roof and rot-resistant construction material.
- All contaminated runoff must be collected, and clean surface water directed away from the composting facility.
- Fully composted birds, where there is no sign of bones or feathers, can be added to manure for eventual land spreading.
- Primary bin areas cannot exceed 5 m^2 (50 ft^2). Oversized bins become anaerobic and inefficient.
- Bin size and arrangements may vary to suit individual needs and preferences. Ensure bin size and arrangements permit easy access with conventional material handling equipment (eg. skid loader, front loader, etc.).
- Composting facilities should be located near the manure storage. They may be attached to manure storage buildings provided double-wall construction provides a minimum of 150 mm (6 in) of airspace between manure and compost to allow for air movement.
- The composting site be located a minimum of 15 m (50 ft) from a watercourse and 30 m (100 ft) from wells or domestic water intakes.
- Capacity of composting facilities must be sufficient to dispose of a normal mortality rate of 1½ head/1000 of market aged birds weighing approximately 2.0 kg (4½ lbs). Expanded capacity to contain an excessive mortality rate (2½ head/1000) is desirable, but not essential.
- All composting facilities should, in addition to the above, incorporate at least two "mini" composters. These simple, modular units should be sized to contain and process a normal mortality for up to 25 days (half the broiler production cycle).

For more detail on composting, see the Engineering Note on Poultry Carcass Composting available at the B.C. Ministry of Agriculture, Fisheries and Food offices indicated on the inside the back cover. See Figure 4.1 for a sketch of one type of poultry carcass composter.

4.4.3 Municipal Refuse Sites

In some cases, municipal refuse pits are made available to poultry producers for the disposal of dead birds. Birds must be dead before their arrival at the disposal pit. Dead birds should be taken to the disposal area daily or, where this is impractical, be stored in airtight containers preferably frozen prior to disposal at less frequent intervals.

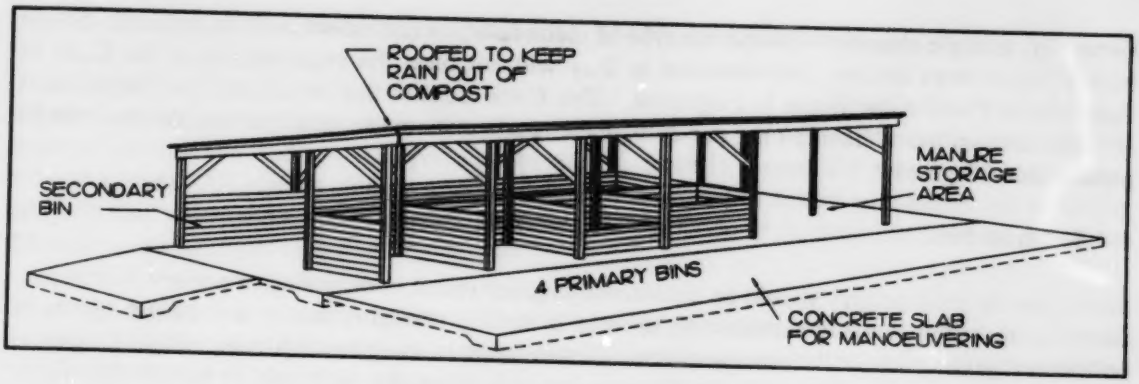


Figure 4.1 Poultry Carcass Composter

4.4.4 Incineration

Figure 4.2 shows an example of an incinerator. Where incinerators are employed for dead bird disposal, they should:

- where possible, be located so that prevailing winds carry exhaust fumes away from neighbours,
- be 30 m (100 ft) minimum from wells or domestic water intakes,
- be fire safe,
- consume all material fed into them.

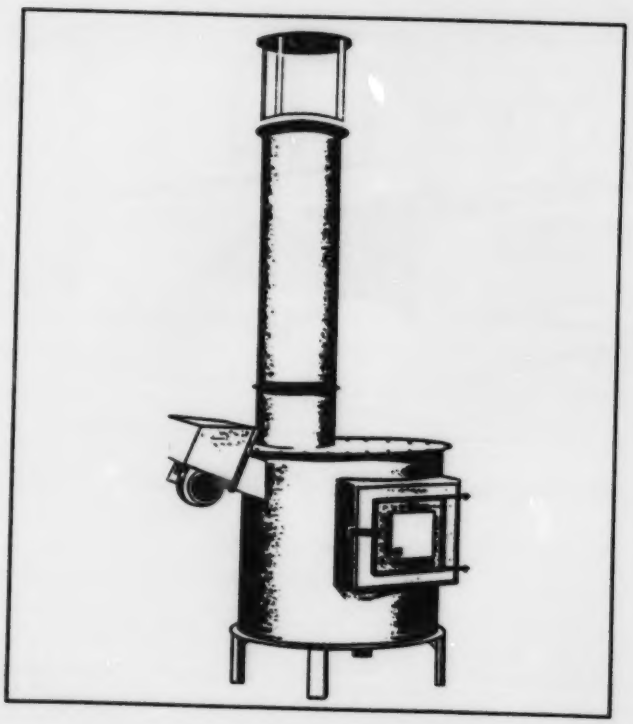


Figure 4.2 Example of an Incinerator

Generally, a single chamber - two burner type of incinerator, or equivalent, will be required. Single burner incinerators are not recommended as they will not meet the requirements in the Code of Agricultural Practice for Waste Management. This Code requires that emissions from incinerators shall not contain more than 180 mg per cubic meter particulate matter and that opacity shall not be greater than 20 percent.

4.4.5 Burial Pits

Burial pits for dead poultry should be considered as a last resort in disposing of poultry mortalities. Direct earth burial is not recommended because it attracts predators and is a potential source of pollution to groundwater. Before a poultry producer considers using burial pits as a disposal system, a Best Agricultural Waste Management Plan (explained in Appendix A) should be done for the farm. If burial pits must be employed, they need to be located at least 120 m (400 ft) from any well or domestic water intake and 30 m (100 ft) from any other surface water. Burial sites need to be staggered throughout the property, not crowded together, and dead birds must be covered the day they are buried with sufficient earth (approximately 1 m (3 ft)).

A burial pit should contain no more than 700 kg (1,500 lbs) of dead poultry. Burial pits should be used only at locations where the groundwater level is well below the pit bottom and where soil type permits good aeration. Do not dig a burial pit on a floodplain or in low-lying areas, where water can seep into the pit.

Trench type pits are no longer acceptable because they are unsafe, dogs and wild animals unearthing dead birds, difficulty in back filling in the winter, and groundwater pollution.

SECTION 5 POULTRY MANURE STORAGE

Poultry manure is a valuable byproduct of poultry operations. However, to realize the potential value of the manure and to avoid pollution problems, there is a need for a well planned manure storage system. All manure storage systems should be evaluated to ensure pollution is not occurring and that the facility meets the requirements outlined in the Code of Agricultural Practice for Waste Management.

A storage facility (see example shown in Figure 5.1) is a permanent structure or location designed and operated to contain manure in an environmentally sound manner for the period of time required to allow the manure (and other wastes) to be used as an organic fertilizer. Timing and amount of manures applied on cropland is explained in Section 6 regarding Land Application of Poultry Manure.

Field storage is a temporary field location to store manure just prior to spreading on cropland. Only solid manure may be stored in a field storage area. Field storages are not meant to replace storage facilities and should, therefore, only be used in the spring, summer and early fall. Field storage during the winter is not recommended due to risk of polluting surface and groundwater. In areas of high rainfall, 600 mm (24 in) precipitation, field stored manure must be covered (e.g. tarped) and not located in low areas that are subject to flooding. See Sections 5.1 and 5.2.2, Field Storage.

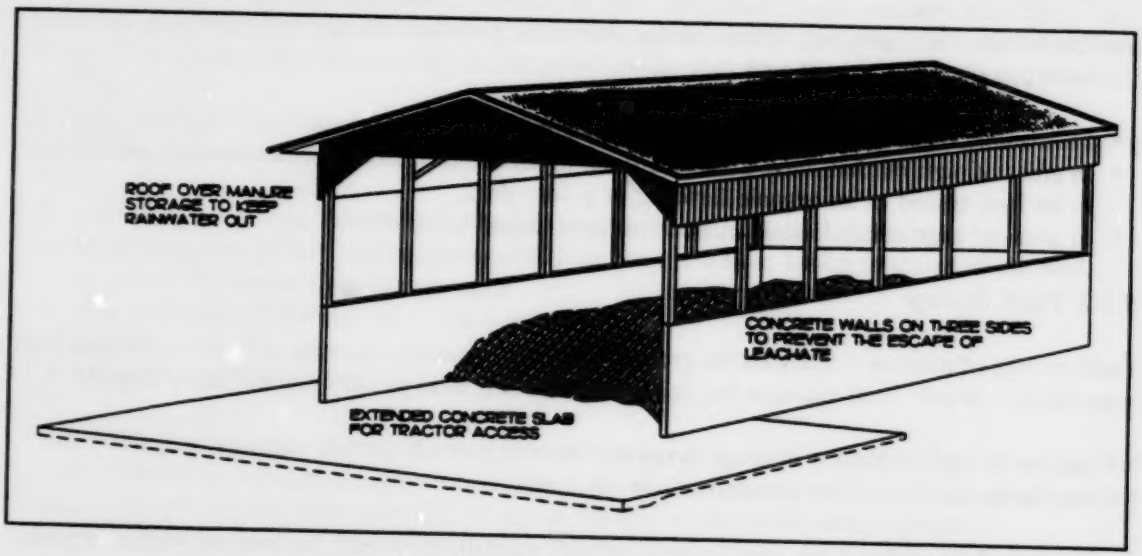

ROOF OVER MANURE STORAGE TO KEEP RAINWATER OUT
CONCRETE WALLS ON THREE SIDES TO PREVENT THE ESCAPE OF LEACHATE
EXTENDED CONCRETE SLAB FOR TRACTOR ACCESS

Figure 5.1 Example of a Solid Manure Storage Facility

5.1 MANURE STORAGE STRUCTURES

There are similar siting and sizing considerations for runoff and manure storage structures regardless of the type of confinement. All manure storage structures should:

- be located a minimum of 15 m (50 ft) from any watercourse,
- be located a minimum of 30 m (100 ft) from wells or domestic water intakes,
- where possible, be located away from and out of sight of public places and nearby residences,
- be located on a well drained site, properly graded to divert surface water away from the storage,
- be watertight,
- have the design approved by a professional engineer for both earthen and concrete structures,
- be adequately fenced to prevent the accidental entry of humans, animals or machinery, and
- be sized to provide storage that will enable the user to spread manure at the correct time of year as an organic fertilizer to meet crop requirements.

5.2 SOLID MANURE STORAGE

Solid manure is considered as having 20% or more solids and will not flow when piled.

5.2.1 Storage Facility

Uncovered solid manure storage structures may be suitable in areas where rainfall is less than 600 mm (24 in) per year. Any runoff from an uncovered solid manure storage will have to be collected. Uncovered manure storages should:

- have a concrete base and a curbed sidewall on at least two sides, and
- in areas of high rainfall, have a manure sump to collect and store the contaminated leachate to be land spread as an organic fertilizer at a later date,
- in areas of high rainfall, solid manure storages should be covered.

5.2.2 Field Storage

Field storage of manure directly on the ground is not recommended in areas of high rainfall and high watertables. Where field storages are being used to store solid poultry manure, they should:

- not be located in natural drainage ways or where runoff will access waterways, and
- not be located on coarse textured or gravelly soils.

In the event field storages are used in areas of high rainfall, they must be covered with a tarpaulin or plastic in such a manner as to keep rainwater from entering the pile and prevent the escape of effluent. This is the least desirable method of storing manure because of the difficulty in containing effluent. Due to the high management required to operate and monitor a covered field storage in a manner that does not cause pollution, this system should only be used until a storage facility can be built.

When field storages are used the waste should be loaded on the storage area quickly, then covered and left until used. Field storages are not meant to be loaded on a daily or weekly basis.

5.3 SEMI-SOLID MANURE STORAGE

Poultry manure scraped from shallow pit cage houses or partially slotted floor litter houses, where only a minimal amount of litter is used, but no attempt is made to dry the manure, will be semi-solid.

In the wetter areas of the province, semi-solid manure should be stored in closed shed-type, manure holding structures. These structures should:

- have reinforced concrete walls, or equivalent, to adequately contain the manures,
- have a concrete floor which is sealed to the walls to provide a manure tight storage and eliminate the entrance of ground or surface water,
- in areas with high watertables, be constructed entirely above ground to minimize seepage of groundwater into the structure (this will also facilitate the cleaning out operation),
- be adequately roofed to keep out rain and snow in areas with high annual or seasonal precipitation,
- if roofed, be well ventilated to prevent the accumulation of hazardous gases in the head space area and to aid the drying of the stored manure,
- have access doors constructed of tight tongue-and-groove pressure treated timber, or equivalent. Seepage, if any, should be contained so as not to create a pollution hazard,
- if fitted with a ramp, have guard rails and safety stops on the ramp to prevent a tractor from being buried in the manure, and
- have a suitable concrete slab area for tractor and manure spreader activity. This slab would be sloped away from the building so that water on the slab does not enter the storage area.

In colder and drier interior regions of the province, an uncovered, three sided storage structure may be suitable. These structures should:

- have reinforced concrete sidewall or equivalent on three sides of the structure,
- have a concrete, floor, sloping downward from the open side, which is sealed to the walls to provide a manure tight storage, and
- have provision to control and contain seepage.

5.4 LIQUID WASTE STORAGE

Poultry housing facilities and waste management systems that involve the handling and storage of poultry manure as a liquid are not recommended for poultry operations in B.C. However, where liquid holding tanks are employed for storage of poultry wastes, these tanks should:

- be constructed of sulphate resistant concrete with a rated strength of 20 mpa (3,000 psi) or greater,
- if very large, have cross wall and/or baffles to facilitate agitation prior to emptying,
- if unroofed, be sized to allow for precipitation storage (designed for highest precipitation during a 25 year period),
- if constructed entirely or partially above grade level,
  - have tight fitting closures on loading and/or unloading ports; and
  - be equipped with a manure level indicator that can be read from the ground,

- if constructed entirely below grade level, and covered,
  - have access ports covered with a minimum of 20 kg (40 lb) steel covers or equivalent childproof covers; and
  - have adequate surface drainage around the tank to prevent the entry of surface water,
- if constructed with less than 1.5 m (5 ft) of the wall above grade level, and not covered, be adequately fenced to prevent humans, farm animals, and machinery from accidentally falling into the tank, and
- if constructed below slotted floors within a poultry building,
  - be designed to allow 300 mm (1 ft) of freeboard space at the top of the tank; and
  - be adequately ventilated to prevent the accumulation of hazardous gases in the head space area or in the area of animal occupancy.

Because of severe odour and fly problems, lagoons are not recommended for the storage of liquid poultry manure.

5.5 STORAGE CAPACITY

Storage of manure is required during the times of the year when manure cannot be applied to cropland due to the risk of causing pollution. Ideally, a storage sized to contain six months (26 weeks) manure production would allow a producer to use manure from the farm as an organic fertilizer with the least chance of causing pollution. Table 5.1 suggests minimum storage duration required for various areas of the province.

Table 5.1 Suggested Minimum Manure Storage Duration

Vancouver Island	18 - 30 weeks
Lower Fraser Valley	18 - 30 weeks
South Okanagan	20 - 26 weeks
North Okanagan & Thompson	22 - 30 weeks
Remainder of Province	24 - 30 weeks

The suggested manure storage requirements in Table 5.1 vary depending on the location in the province, soil type (see Section 6.4.2, Application Timing), soil temperature, and crop grown. Variation in storage requirements within a region depend on soil type and local rainfall which affect the ability to get onto the land to spread manure.

Manure storages should be designed to hold manure during the year of highest rainfall over a 25 year period. During rainy years in the south coastal area, most fields will be too wet to allow for spreading during late fall, winter and spring. Therefore, south coastal farms that are not spreading manure on grass grown on very well drained soils will need 22 weeks storage, as a minimum.

To obtain an estimate of manure storage capacity requirements:

- Multiply the weekly manure production rate per bird leaving the barn found in Table 5.2 by the average number of birds on the farm to determine weekly manure production rate.
- Determine weekly manure production rates for each type of poultry on your farm and add the various weekly rates together.
- Multiply the total weekly production by the required storage duration in Table 5.1 to obtain the total storage capacity required.

Example

Calculation of Poultry Manure Storage Requirements Based on Volume

- 10,000 broiler birds on the farm (average)
- no other poultry types on the farm

Weekly manure volume = Table 5.2 value x 10,000 birds
= 0.67 litres/bird/week x 10,000 birds
= 6,700 litres/week

Storage capacity required = Table 5.1 value x weekly manure production
= 22 weeks x 6,700 litres/week
= 147,400 litres or 147 m^3
= 5,159 ft^3

To convert units: 1,000 litres = 1 m^3
1 m^3 = 35 ft^3

Table 5.2 Average Weekly Manure Production Rates per Bird					
Poultry Type[a]	Manure as Excreted		Housing System[b]	Manure Leaving the Barn (at the end of each cycle)	
	Weight kg/wk	Volume l/wk		Weight kg/wk	Volume l/wk
Pullets	0.27	0.27	cage[c] floor[d]	0.09 0.13	0.27 0.41
Layer	0.91	0.91	cage[c] floor[e]	0.30 0.38	0.91 0.92
Broiler Breeder Pullets	0.34	0.34	floor[d]	0.17	0.54
Broiler Breeder Layer	1.0	1.0	cage[c] floor[e]	0.33 0.5	1.0 1.26
Broiler Chicken	0.38	0.38	floor[d]	0.2	0.67
Roaster Chicken	0.40	0.40	floor[d]	0.2	0.63
Turkey Broiler	1.4	1.4	floor[d]	0.65	2.0
Turkey Heavy Hen	2.0	2.0	floor[d]	0.92	2.9
Turkey Heavy Tom	2.3	2.3	floor[d]	1.06	3.3

To convert to Imperial units: 1 kg/wk = 2.2 lb/wk
1 l/wk = 0.035 ft^3/wk

a Typical weights and ages as explained in Table 3.1.
b Cage and floor assumptions as explained below.
c Manure removed from barn at 25% moisture content with a density of 320 kg/m^3 (20 lb/ft^3).
d 50mm (2 in) shavings placed on floor. Manure and litter removed from barn at 25% moisture content, with a density of 320 kg/m^3 (20 lb/ft^3).
e ⅓ litter floor, ⅔ slatted floor. Manure and litter removed from barn at 40% moisture content, with a density of 400 kg/m^3 (25 lb/ft^3).

SECTION 6 LAND APPLICATION OF POULTRY MANURE

Animal manures are a valuable source of plant nutrients and organic matter and contain a vast array of organisms that add to the biological activity of soils. If not managed with sufficient care, however, manures can be major sources of pollution and contribute to contamination of surface and groundwater.

This section provides information on composition and benefits of poultry manure, application rates, factors affecting water contamination from manure, practical guidance on land application, and manure spreading equipment.

6.1 COMPOSITION AND BENEFITS OF MANURE

Manure management systems consist of various management phases including manure collection, storage, transport and land application. Since manure is a dynamic organic material continually undergoing biological and chemical changes, each phase of management may result in losses and transformations of the beneficial nutrients in the manure. Therefore, the value of manure as a fertilizer depends on the quantity and form of nutrients present when it is applied to land. Manure production data from various types of poultry are summarized in Table 5.2. These figures are useful in determining storage volume requirements to permit land spreading for optimum results at various times of the year.

6.1.1 Fertilizer Nitrogen Value of Manure (N)

Nitrogen in manure exists in two forms, inorganic and organic. Inorganic nitrogen is the simple, soluble form that plants can utilize. After application to land, it is converted by soil bacteria to a form - nitrate (NO_3) - that can be used by the crops or lost from the root zone through leaching. Denitrification of the nitrate results in losses of nitrogen to the atmosphere. Manure solids contain nitrogen in the organic form. Until the organic matter is biologically decomposed in the soil, the nitrogen remains unavailable for plant use. Nitrogen in organic form is desirable since it acts as a reserve in the soil and is slowly released for plant use.

A rule of thumb regarding nitrogen availability from poultry manure is to assume that 75% to 90% of the nitrogen found in the manure is available the year of application. If manure is applied during the fall or winter, it is estimated that up to one third of the available nitrogen (25% to 30% of the total) may be lost due to leaching, denitrification or by runoff. Studies suggest that up to 25% of the total nitrogen can be lost into the air if manure is not immediately incorporated into the soil and up to 50% is lost if not incorporated within a week.

6.1.2 Fertilizer Phosphorus Value (P)

Research indicates that 50% of total applied phosphorus in manure is available to the crop in the year it is applied. Most of the phosphorus contained in manure is in the organic form, therefore its availability is dependent on the rate at which soil organisms break down the organic material (mineralization) and release phosphorus.

Where poultry manure has been applied on a regular basis for many years, the ability of the soil to retain phosphorus is reduced. On such soils, the availability of phosphorus is increased. The availability of the phosphorus from a particular application of manure approaches 100% and should be assumed to be as effective as chemical fertilizer in supplying phosphorus to crops.

6.1.3 Fertilizer Potassium Value (K)

All potassium in manure is available to the current crop. However, since soils that regularly receive manure are not often lacking in this nutrient, further details of its utilization are not elaborated upon here.

6.1.4 Trace Element Value

While the major fertilizer nutrients are considered to be nitrogen, phosphorus and potassium, manure also contains the secondary nutrients sulphur, magnesium and calcium as well as the micronutrients iron, manganese, boron, chlorine, zinc, copper and molybdenum. The availability of these elements as plant nutrients, varies depending upon the soil type and soil acidity.

6.1.5 Value of Manure as a Soil Conditioner

Manure applied to soil may have a very positive benefit by improving its physical structure. The decomposition of manure by bacteria contributes to improved aeration, improved permeability, and water holding capacity of the soil.

6.2 LAND APPLICATION RATES

Management is the key to using manures to promote crop production and soil improvement while minimizing any hazard to the environment. Management means application of manure at rates and times of year that:

- are compatible with the nutrient requirements and growing characteristics of the crop;
- take into account soil characteristics, drainage and the slope of the land; and
- recognize the need to protect the quality of surface and groundwaters.

6.2.1 Manure Application Rates Based on Nitrogen

Acceptable application rates for poultry manure to typical crops on soils with more than 10% organic matter are found in Table 6.1. These rates are based on the nitrogen requirement of the crop and manure application annually. The number of "Bird Places" on a farm is the average number of birds on the farm at any one time. See Appendix D for descriptions of assumptions used in creating Table 6.1. Heavier application rates may be allowed for soils with organic matter less the 10% and/or when manure is spread infrequently (less than once every two years). These heavier rates are determined by multiplying the Adjustment Factors (Table 6.2) by the values found in Table 6.1.

Table 6.1 Acceptable Rates for Annual Application of Poultry Manure						
Based on the amount of nitrogen required for acceptable crop yields[a]						
Crop	Yield as Harvested (tonne/ha)	N Removal (kg/ha)	Animal Places of Manure per Hectare			
			Broilers	Layers	Turkeys	Pullets
Silage Corn	20[b]	325	982	635	435	1049
Silage Corn	15[b]	245	741	479	328	791
Grass	16[b]	400	1511[c]	977[c]	669[c]	1615[c]
Grass	12[b]	300	1133[c]	732[c]	501[c]	1211[c]
Grass	8[b]	200	756[c]	488[c]	334[c]	807[c]
Cereals--whole	5	150	453	293	201	484
Cereals--grain	5	100	302	195	134	323
Broccoli	12	120	363	234	160	387
Brussels Sprouts	13	130	393	254	174	420
Cabbage	60	220	665	430	294	710
Carrots	40	120	363	234	160	387
Cauliflower	16	100	302	195	134	323
Sweet Corn	20	160	484	313	214	517
Lettuce	60	150	453	293	201	484
Onions	55	150	453	293	201	484
Potatoes	50	230	695	449	308	743
Raspberries	13	100	302	195	134	323

To convert to Imperial units: 1 Tonne/ha = 0.45 ton/ac
1 kg/ha = 0.89 lb/ac
1 bird place/ha = 0.40 bird place/ac.

a See Appendix D for description of assumptions used.
b Yield is in dry matter.
c The volume of poultry manure required to achieve these application rates may harm the grass stand due to smothering. If smothering occurs, rates of application must be reduced (See Section 6.2.3). In some parts of the province potential grass yields may be lower than those shown above. In such cases manure application rates must be reduced accordingly.

Table 6.2 Application Rate Adjustment Factors
Adjustment Factors for Values Found in Table 6.1
1. Soil organic matter: less than 5% - 1.4 5 - 10% - 1.2 more than 10% - 1.0
2. One-time or infrequent applications (less than once every two years): layer manure - 1.1 pullet, broiler and turkey manure - 1.25

Example
Calculation of Bird Places per Hectare or Acre
- corn crop(20 tonnes/ha): Table 6.1 value = 982 broiler bird places per hectare - soil organic matter, 7%: Table 6.2 Adjustment Factor = 1.2 - infrequent use of manure: Table 6.2 Adjustment Factor = 1.25 Broiler Bird Places = Table 6.1 value x Table 6.2 Adjustment Factors Bird Places per Hectare = 982 x 1.2 x 1.25 = 1,473 Conversion Bird Places per Acre = 1,473 x 0.4 = 589
Calculation of Land Requirement for Manure Application to Cropland
Land Requirement for 10,000 Place Broiler Farm = $\frac{\text{Farm Size (number of bird places)}}{\text{Bird Places per Hectare}} = \frac{10,000}{1,473} = 6.8$ ha (16.8 ac)

The application rates in Table 6.1 are based on the amount of nitrogen removed in the above-ground, harvested portion of various crops. The amount of manure applied each year should be governed by the amount of nitrogen removed in the crop. If the amount of nitrogen applied in manure exceeds crop needs, then over time, nitrogen losses to the environment will be excessive.

For example, a high yielding silage corn crop will take up in the order of 325 kg/ha (289 lbs/ac) nitrogen into the above-ground portion of the crop, which is then removed from the field at harvest time. It is appropriate to apply sufficient manure to supply this amount of nitrogen prior to or during the growing season.

Other factors, such as the amount of nitrogen in the soil, amount of manure added in previous years, the length of time manure is left on the soil surface prior to incorporation, amount of crop refuse left in the field, and presence or absence of a winter cover crop, can influence suggested application rates.

Therefore, the values in Table 6.1 are to be considered a general guide to manure application rates. **This table should not be used as the sole mechanism for judging compliance with the Code of Agricultural Practice for Waste Management**. However, any poultry operation which has access to sufficient land to meet the application rates indicated in Table 6.1 will be in compliance with the Code, providing no pollution occurs. Alternatively, any operation using application rates two or more times the rates in Table 6.1, may not be in compliance and may have to reduce the rate of application. Any operation using application rates in excess of those indicated should request a "Best Agricultural Waste Management Plan" (explained in Appendix A) to obtain guidance on any changes needed to ensure compliance with the Code.

It is recommended that all of the manure be applied in the spring prior to crop growth. This will result in optimum crop yields without any risk of nitrate leaching over the fall and winter period. If manure application is split between spring and fall, potential leaching will increase. Fall and winter applications should be less than 40% of the total amount of manure applied during the year. Refer to Section 6.4.2 for conditions.

Table 6.3 shows the average amount of nutrients found in typical poultry manures. This table can be used by crop producers who are using poultry manures as an organic fertilizer to determine how many tonnes of manure are needed per hectare (ton per acre). If the manure is not incorporated immediately, some of the ammonia (NH_3) will be lost. Generally, all of the ammonia will be lost to the air if the manure is not incorporated within 48 hours. The amount of nitrogen available for crop use is the total nitrogen if manure is incorporated, and is the total nitrogen less the ammonia nitrogen if not incorporated. Crop producers should apply manure to soils at a rate that balances the nutrient in the manure with the nutrients removed by the crop.

By knowing the manure management system, the application rates required to achieve a desired crop yield can be determined. For more information contact the B.C. Ministry of Agriculture, Fisheries and Food, Soils and Engineering Branch. A computer program can be operated to provide a prediction of the nutrient content of the poultry manure and crop response. See Appendix A , Nitrogen Behaviour Simulation Computer Model, or read the B.C. Ministry of Agriculture, Fisheries and Food publication, Manure Management Guidelines (this guideline covers manure management for dairy, swine and poultry operations).

6.2.2 Manure Application Rates Based on Phosphorus

Phosphorus is potentially a serious contaminant of surface water. In virtually all cases of phosphorus contamination due to agricultural activities, the source of phosphorus is surface runoff. Runoff of contaminated water can be prevented by incorporating manure into the soil, eliminating spreading on sloping lands when runoff may occur, and preventing spreading during times of the year when there is a high risk of runoff. Therefore, it is not suggested to base application rates on phosphorus uptake by crops.

Table 6.3 Typical Nutrient Contents of Poultry Manure[a]						
Poultry Type	Housing System (number of samples)	Moisture Content (%)[b]	Nitrogen		Phosphate Total as (P_2O_5) (kg/tonne)	Potash Total as (K_2O) (kg/tonne)
			Total (kg/ tonne)	NH_3 (kg/ tonne)		
Layer Pullets	cage (6) floor (2)	56 24	29.3 30.9	5.6 5.1	22.5 29.8	11.2 11.0
Layers	cage[c] (15) cage[d] (5)	59 38	16.4 28.0	4.6 4.5	28.4 35.1	9.9 12.5
Broiler Breeder Pullets	floor (6)	33	17.4	4.4	25.2	7.6
Broiler Breeder Layers	floor (12)	46	19.6	4.1	30.0	10.4
Broiler Chicken	floor (14)	25	34.7	5.7	25.0	13.4
Roaster Chicken	floor (8)	19	48.5	4.9	36.4	14.6
Turkey Broiler	floor (5)	25	37.3	4.8	35.1	15.7
Turkey Heavy Hen	floor (7)	31	30.9	8.4	32.1	14.3
Turkey Heavy Tom	floor (5)	36	26.6	8.3	21.1	11.3

To convert to Imperial units: 1 kg/tonne = 2.0 lbs/ton

a Data collected by Poultry Producers Sustainable Farming Group on Fraser Valley Poultry farms 1991/92.
b If the moisture content of manure is different than these values, nutrient content per tonne (ton) will also change.
c Cage housing system, ventilation fans in manure pit or barn wall.
d Cage housing system, manure drying fan in manure pit.

6.2.3 Manure Application Rates to Grassland

Well managed, productive grass swards have a high requirement for nitrogen, and extensive root systems are very efficient in taking nitrogen compounds from the soil profile. Therefore, leaching losses are generally low under productive grass swards. The low leaching losses of productive grass stands allows this crop to receive a higher manure nitrogen application rate per unit of nitrogen removed by the harvested portion of the crop compared to the other crops listed in Table 6.1. Some fall and winter applications of manure can be considered if the following conditions are met:

- The land is not subject to flooding or runoff.
- The grass sward is managed for high yields and all vegetative growth is removed from the field during the growing season.
- The grass sward is not used for grazing.
- Application of manure does not harm the sward by causing smothering and scorching.

6.3 FACTORS AFFECTING WATER CONTAMINATION FROM MANURE

6.3.1 South Coastal Region

Soil Characteristics

The proportions of sand, silt, clay and organic matter in a soil determine the water and nutrient holding capacity. In general, soils with a high clay and/or organic matter content have a relatively high capacity to hold water and nutrients in the root zone. Sandy soils, on the other hand, have a low capacity. Therefore, the leaching of nutrients from sandy soils during the winter months is much greater than from more heavy textured soils or soils with high level of organic matter. Leaching of nutrients from soils could result in groundwater quality degradation.

Drainage

Poorly drained soils become saturated during late fall, winter and early spring. After saturation, precipitation can no longer enter the soil therefore, water accumulates on the soil surface and eventually runs off into adjacent ditches or other watercourses. When this happens, materials, such as manures, that have been applied to the soil surface are removed with the water, and degrade receiving waters.

Slope

The potential for runoff from sloping ground is much greater than on flat soils. Extra precautions should be taken when applying manure to sloping lands to ensure nutrient rich water does not runoff into adjacent watercourses.

Nitrate in the Root Zone

The nitrate form of nitrogen is of major concern due to its potential to contaminate drinking water. Nitrate is also the dominant form of plant available nitrogen found in agricultural soils. Most of the nitrate in the root zone in the fall of the year is leached from the soil over the winter months. Where soils are over sensitive groundwaters or adjacent to surface waters, the nitrate has a high potential of contributing to water contamination.

Excessive levels of root zone nitrate are found in soils where the spring application rates of manure and fertilizer have been high in relation to the ability of the crop to use the nitrogen, or in soils where there has been a fall application of manure after harvest.

Lack of Cover Crops

Permanent grassland and, to a lesser extent, fall planted cover crops take up soil nitrates (and other nutrients) during fall, winter and early spring. In addition, cover crops keep the soil surface open thereby reducing or eliminating ponding and surface runoff. Bare soil, on the other hand, is susceptible to leaching, surface sealing, ponding and runoff.

6.3.2 Interior Regions

Spring Runoff

In the areas of the province where soils are frozen and snow accumulates during the winter months, snowmelt water can runoff the land into adjacent streams or bodies of water. Any manure that has been applied to the land since the previous fall can leave the land with the melt water and contribute to water contamination.

6.4 PRACTICAL GUIDANCE ON LAND APPLICATION

6.4.1 Components of Environmentally Sound Land Application

The following must be taken into consideration if manures are to be managed in an environmentally sound manner.

Long-term Manure Storage

Maximum benefit is derived from manure when it is spread on the land in spring or summer when leaching and runoff risks are low and crop growth and nutrient uptake are high. Adequate storage makes this possible by allowing more flexibility in choosing the correct time to apply the manure. See Table 5.1 or Section 5 Poultry Manure Storage.

Adequate Land Base

In order to adhere to the recommended application rates, sufficient land must be available for the safe use of the amount of manure produced each year (see Table 6.1).

Incorporation of the Manure

Incorporation either by injection, plow down, other tillage methods or irrigation should be practised to maximize nutrient recovery, reduce the likelihood of manure runoff and reduce odours.

Odour Control

Intensive livestock production facilities frequently give rise to complaints associated with the land application of manure. Consideration of neighbours with respect to time of day and weather conditions when spreading manure can do much to avoid conflict. Longer storage periods to reduce the frequency of spreading, as well as immediate incorporation of the manure into the soil to minimize odour are encouraged.

Spreading Techniques to Prevent Water Contamination

Poultry manure should <u>not</u> be spread:

- within 5 m (17 ft) of a bank or a slope leading to any open watercourse or within 30 m (100 ft) of any well or domestic water intake. These distances should be increased where the ground slopes toward the watercourse or well.
- on steep slopes where erosion and/or surface runoff is likely to occur,
- on saturated soils, where manure will not infiltrate into the soil,
- within the high water mark of field depressions during times of the year when there is a high risk of direct surface runoff to an open watercourse,
- in excess winds where drift can occur,
- on frozen or snow covered ground where runoff of snowmelt to open watercourses might occur,
- on areas having standing water.

6.4.2 Agronomic and Environmental Considerations at Various Times of the Year

January to March

<u>South Coastal Region</u>: If the land is subject to flooding and/or runoff, no manure should be applied because of the high risk of contamination of adjacent waters. If, however, flooding is controlled through adequate on-farm and regional drainage systems and no runoff occurs, some manure can safely be applied on grassland or land seeded to a winter cover crop. November and December, plus January to March manure applications should be less than 40% of the total amount of manure applied during the year. Manure should not be applied to bare land, or to frozen land or land covered with snow where there is a risk of runoff.

<u>Interior Regions</u>: In most cases, manure application cannot be contemplated due to frozen soils and snow cover. If field access is possible, manure application should only be considered if there if minimal chance of runoff during the spring breakup period.

April to May

On annually cropped land, apply and immediately incorporate sufficient manure to supply the amount shown in Table 6.1 or up to 75% of the crop requirement for nitrogen. Do not attempt to completely fertilize the crop with manure. Excess manure will result in a high rate of nitrate production in the latter part of the growing season and after harvest when nutrient uptake is minimal. Supplement the manure with fertilizer at planting or side dress time.

June to August

If manure must be applied, in most cases it can be applied only to grassland due to the presence of actively growing crops on other lands. Manure nitrogen efficiency for grassland can be greatly increased by irrigation immediately following application, or by application of very wet slurries (more than 95% moisture content). Application of additional fertilizer nitrogen to grassland should be fine tuned according to the protein content of the forage. Research has shown that grasses with a protein level of 20% or more have a high probability of nitrate accumulation and/or high levels of rumen-degradable nitrogen compounds.

Although manure cannot be applied to annual crops during this period, crops can be supplemented with fertilizer nitrogen. A late spring soil test has been found to be useful in indicating whether or not a response to added nitrogen is to be expected. The critical range is 20 to 30 kg/ha (17 - 25 lbs/ac) nitrate nitrogen in the plow layer 0 - 20 cm (0 in - 8 in). Soils below this range are usually deficient in nitrogen and require supplementation before the crops will achieve sufficient yields. Soils above this range will generally supply all of the crops' nitrogen requirements.

September to October

South Coastal Region: This is the most critical time of the year if manures are to be managed in an environmentally sound manner. On annually cropped land, crops have reached maturity and nutrient uptake has ceased. Soil temperature and moisture conditions are near optimal for formation of nitrates in the soil. Therefore, any added manure will only further contribute to the problem of fall nitrate levels and overwinter leaching.

If manure must be applied during this period, it should be restricted to grasslands that are well drained and not subject to flooding or runoff. Grasses are actively growing and their roots will capture much of the nitrate and prevent leaching.

On other lands, winter cover crops must be planted, preferably before September 15, before any application should be contemplated. These crops can act as 'catch crops' to catch the nitrate in the root zone and reduce leaching. Rates of application on these lands should be lower than on grasslands due to the more immature root system.

Interior Regions: Because of frozen soils and low winter precipitation, winter losses of nitrate due to leaching are minimal. Therefore, a high percentage of any nitrate left in the root zone following harvest will be retained for subsequent crops. A fall or spring soil test will assist producers to take advantage of nitrogen from manure and reduce the need for fertilizer nitrogen.

November and December

South Coastal Region: With the onset of winter, soils cool to the point where there is very little formation of nitrate in the root zone. However, many soils are now too wet to allow ready access for spreading without causing severe soil compaction.

If, however, the soil is sufficiently dry to support traffic and flooding and runoff never occurs due to adequate on farm and regional drainage systems, some manure can safely be applied on grassland or land seeded to a winter cover crop. November and December, plus January to March manure applications should be less than 40% of the total amount of manure applied during the year. Manure should not be applied to bare land.

Interior Regions: See January and March.

6.5 MANURE SPREADING EQUIPMENT

Poultry manure spreading equipment should:

- be of tight construction so that no manure will spill from it during transport,
- be operated in such a manner that the wheels do not carry manure onto public roadways, and
- be filled in such a manner that manure does not spill from the sides of the equipment creating unsanitary, messy conditions.

SECTION 7 ALTERNATE USES OF POULTRY MANURE

Utilization of poultry manure as a fertilizer for crop production is generally recommended at this time. However, cases do exist, and more are likely to develop, where insufficient crop land is available to recycle all manure as a fertilizer. An alternative to direct land application of poultry manure is composting and using the compost for off-farm fertilizer users. In this way some, or all, of the manure is directed away from the farmland.

7.1 COMPOSTING OF POULTRY MANURE

Composting refers to an aerobic process by which the organic matter of raw manure is converted to humus. Both the process itself and the product are essentially odourless, and the compost has considerable value as an organic soil conditioner and fertilizer.

Windrow composting refers to the process in which the raw manure is piled in heaps about 1½ to 3 m (5 to 10 ft) high. The piles are turned periodically to introduce air to the composting mixture and to ensure that all the material is uniformly composted. Windrow composting is relatively simple and inexpensive, but takes up to several months for completion. To hasten the process, complex high rate composting machines have been developed that can mechanically mix and aerate the composting material. These machines are expensive, but could be practical on a cooperative basis involving several producers.

To ensure that pollution is not caused at the composting site, the following should apply:

- Be located a minimum of 15 m (50 ft) from a watercourse, and 30 m (100 ft) from wells or domestic water intakes.
- Windrows are not located on coarse textured or gravelly soils.
- All clean surface water is diverted away from the composting site.
- All contaminated surface runoff from the composting area is contained to prevent flow directly into a surface watercourse. Contained runoff must be land spread at a time when runoff to surface water does not occur and according to the principles in Section 6, Land Application of Poultry Manure.
- Raw and composted material is stored in a suitable storage structure as outlined in Section 5, Poultry Manure Storage.
- In areas of high rainfall, a roof over the composting area may be required to keep the compost from becoming too wet, and the amount of contaminated runoff that must be stored is reduced.
- In areas of high rainfall, storage of finished compost should be under a roof.

Commercial composting facilities that receive manure or other wastes from more than one farm and sell compost require a permit under the Waste Management Act.

All composting facilities are required to register with B.C. Ministry of Environment, Lands and Parks. For further information on composting, contact Soils and Engineering Branch, B.C. Ministry of Agriculture, Fisheries and Food, see address on inside back cover.

SECTION 8 OTHER ENVIRONMENTAL CONSIDERATIONS

This section deals with a number of other environmental considerations covering soil conservation, woodwaste products, pesticides, farm medical wastes and petroleum products.

8.1 SOIL CONSERVATION

Any consideration of farming activities from an environmental perspective must consider soil conservation. Soil conservation means any soil management practices that minimize soil loss from erosion, or reduce degradation from acidification, salinization, organic matter depletion and compaction, and that increases the overall organic matter and fertility status of the soil.

Soil conservation practices are site dependent. They depend on soil and landscape conditions, type of farming operation and the critical factor of climate. In many instances it is the apparent disregard of the climate that is the major contributor to soil degradation. Provisions must be made to protect the soil resource from degradation due to rain drop impact, rainfall or snowmelt runoff conditions.

Soil degradation from acidification, salinization, organic matter depletion and compaction have their greatest impact on soil productivity on the farm. Soil erosion will have obvious and significant impacts on the farm, but will have less apparent, yet greater impacts, off the farm. On-farm impacts range from loss of nutrients and organic matter to the complete loss of crops and land productivity. Off-farm impacts can be widespread and, if they are severe could be both economically and legally damaging to the farming operation. Soil eroded from farm fields which enters surface water can be considered as a pollutant if the concentration of either sediment or colloidal material affects fish and/or their habitat. Eroded soil can also lead to expensive and unnecessary maintenance of roads and drainage systems. Excessive runoff from a farm site can carry pollutants to surface water. Eroded soil may also contain pesticides or nutrients which could be more harmful to the surface water ecosystem than the soil material itself.

More detailed information on soil conservation practices can be obtained from references such as the Soil Management Handbooks for either the Lower Fraser Valley or the Okanagan and Similkameen Valleys. However, the following are some prevention and abatement measures to control soil erosion by water.

1. Avoid tillage, which would leave bare soil, poor crop growth or crop residue cover, late in the season on sloping (>5% slope) lands.
2. Use permanent pasture or rapid growing cover crops to protect highly erodible sites.
3. Use contour tillage and drainage systems to reduce runoff and saturated soil conditions.
4. If soil is left exposed by an unforseen soil management or crop production problem, attempts should be made to incorporate straw into the soil surface. Any tillage to incorporate straw should be on the contour. Also, efforts should be made to divert any runoff containing soil to a settling pond prior to discharge.

8.2 GAS EMISSIONS THAT CAUSE GLOBAL WARMING

Certain gases in our environment act to trap the heat of the sun, and in turn heat our atmosphere causing global warming. These gases act like a greenhouse trapping the sun's heat. This is known as the greenhouse effect. However, carbon dioxide and other principle gases that contribute to the greenhouse effect are increasing in concentration due to discharges caused by human activities.

The federal government has committed Canada to stabilizing gas emissions that cause the greenhouse effect at 1990 levels by the year 2000. While agriculture absorbs greenhouse gases such as carbon dioxide, agriculture does contribute to the greenhouse gas accumulation by the production of methane, nitrogen oxides and also carbon dioxide. The improved treatment, handling and utilization of manure offers the greatest potential for the reduction of methane and nitrogen oxides. Agriculture must be aware of the need to reduce greenhouse gas emissions and be willing to do its part as Canada develops its strategy to achieve the year 2000 commitment.

The provincial government's clean air strategy may involve initiatives for agriculture that are not addressed in these guidelines. At present it is not clear the affect agriculture has on the greenhouse effect. Research on agriculture's emission sources and potential activities for remediation will help to identify agriculture's role.

8.3 USE AND HANDLING OF WOODWASTE PRODUCTS

The use of woodwaste products are important in the rearing of poultry. The majority of poultry operations that require bedding for poultry use a woodwaste product e.g. sawdust or shavings. This woodwaste breaks down with the manure to form a soil amendment when applied to cropland.

Woodwastes, however, when improperly handled can become a threat to the environment when leachate from stored woodwaste enters surface or groundwater. Leachate is formed when exposed woodwaste has contact with excess water, rainwater or surface water. Leachate is identified as the black liquid forming at the base of the woodwaste pile. This black liquid is deadly to fish and degrades water quality.

Some considerations for the use and handling of woodwaste:

- Woodwaste on farms may only be used for plant mulch, soil conditioning, animal/poultry bedding, ground cover, equestrian facilities, and on farm access ways and berms used in cranberry production.
- Sites where woodwastes are used must be located at least 30 m (100 ft) from any source of water used for domestic purposes.
- Woodwaste shall not be used for a landfill material. To do so requires a permit or approval from the B.C. Ministry of Environment, Lands and Parks.
- Woodwaste products stored on the farm must be stored in such a manner that leachate does not escape to surface or groundwater. Covering stored woodwaste is an effective means of reducing leachate production.
- Woodwaste bedding when removed from the barn must be stored in compliance with Section 5, Poultry Manure Storage of these guidelines and in a manner that does not allow leachate to enter surface or groundwater.

- Repeated application of manure, heavily bedded with woodwaste products, onto untilled cropland may result in a buildup of organic material that could reduce ability of crops to grow.
- For more information, consult the Woodwaste Guidelines developed by and available from the Department of Fisheries and Oceans/Department of the Environment.

8.4 HANDLING AND DISPOSAL OF PESTICIDES

This section of the guidelines outlines good agricultural environmental practices to be followed when using pesticides. As there are numerous articles readily available outlining personal protection when using pesticides, the aim here is to identify steps directed at protection of the environment. The B.C. Ministry of Environment, Lands and Parks has legislation contained in the special waste regulations of the Waste Management Act and the Pesticide Control Act establishes requirements for application of pesticides, permits, certification of applicators and handling, storage and application. The special waste regulations address pest control product wastes and containers, short term storage facilities and management of specific special wastes. Copies of these acts are available from the nearest Ministry of Environment, Lands and Parks office.

The B.C. Ministry of Environment, Lands and Parks also offers to agricultural producers a pesticide applicators course and a handbook for pesticide applicators and dispensers. The B.C. Ministry of Agriculture, Fisheries and Food produces agricultural production guidelines with reference sections on pesticide use.

8.4.1 Transportation

The following items should be considered when transporting pesticides:

- only transport undamaged, and labelled pesticide containers that are securely closed,
- secure pesticides during transport,
- transport pesticides on non-absorbent material (e.g. metal or plastic, not wood),
- the total quantity of pesticide product in your vehicle cannot exceed 500 kg (1,100 lbs), or
- sprayers containing a spray mixture in excess of 5,000 litres (1,320 U.S. gallons) cannot be driven on a road.

8.4.2 Safe Use of Pesticides

Before mixing pesticides:

- identify the pest correctly,
- use only recommended pesticides for the problem,
- read the label and follow the safety precautions,
- ensure application equipment is in good working order and properly **calibrated**, and,
- be prepared to handle a spill, see Section 8.4.7, Pesticide Spills on the Farm for more detail.

While mixing and applying pesticides:

- mix only the pesticide you need for that day,
- always have water available for washing,
- do not exceed the rate specified on the label,
- have an approved backflow prevention device on the waterline that is used for filling the sprayers, and,
- observe a minimum 10 m (35 ft) pesticide free zone from all watercourses.

8.4.3 Drift Control

Drift refers to the movement of pesticide droplets or dust, by wind or air currents, away from the target area onto areas not being targeted. Drifts may be in liquid droplet or vapour form.

Liquid-droplet drift is related to droplet size. The smaller the droplets, the further the wind can carry them from the target. Droplet size or the distance from the nozzle to the target influences the amount of liquid-droplet drift.

Vapour drift from volatile chemicals can continue long after the spraying operation. Small amounts of highly volatile pesticides can injure susceptible plants, such as grapes or tomatoes, as well as impact a watercourse well outside the treated area. This injury often occurs during stable air conditions, which allow the vapours to collect and remain undiluted.

To minimize spray drift, take the following precautions:

- use low spraying pressure to reduce the number of fine spray droplets produced,
- keep boom height as low as possible while maintaining uniform coverage,
- use nozzles that produce drops more resistant to drift, such as low-pressure, flat-fans, flooding or raindrop,
- choose chemicals that do not require high pressure and fine droplets,
- replace or clean faulty nozzles that cause fogging,
- use low volatility chemicals that reduce vapour drift,
- use antidrift additives to increase viscosity at the nozzle orifice so that fewer fine droplets are produced,
- use special, low volume type sprayers, and
- spray when winds are less than 8 km per hr (5 miles per hr). Early morning and evening are often good times, particularly for very volatile chemicals.

8.4.4 Disposal of Pesticide Containers

Empty pesticide containers can be hazardous to health and the environment if not disposed of properly. It is your responsibility to safely dispose of pesticide containers. When the container is empty:

- drain the container into the tank,
- rinse the container as explained in Table 8.1, pouring the rinse water into the sprayer tank each time (each rinse to use 20% or more of the container),

- crush or puncture the container so that it cannot be reused,
- waste pest control product container that has been emptied and rinsed should be disposed of in an approved landfill, or by burying it, but only if:
  - the burial location is on land owned or leased by the person owning the container,
  - the burial location is on flat ground, not in a swale and at least 200 m (660 ft) from surface water or a well,
  - the ground does not consist of gravel, sand or other similarly porous material, and
  - the owner covers it with at least 0.5 m (20 inches) of soil immediately after burial.

8.4.5 Pesticide Storage

Pesticides should be stored in a dry, well ventilated building or "Pesticide Storage Facility" that can be locked. The storage must be located away from watercourses and wells used for domestic purposes to avoid contamination in the event of a spill or a fire. It is a good idea when storing liquid pesticides to provide a sump made of concrete or other impervious material that will contain a spill and subsequent washings from entering the environment.

Table 8.1 Methods for Rinsing Waste Pest Control Product Containers

Excerpt from the special waste regulation of the Waste Management Act

Type of Container	Rinsing Method
Rigid plastic or metal (nonpressurized)	Pressure rinse, or rinse 3 times
Rigid plastic or metal (pressurized)	No rinsing required
Glass bottle	Rinse 3 times
Paper bag	Rinse
Plastic bag	Rinse
Containers labelled "Domestic"	No rinsing required
Any container type not listed above	As approved

Further considerations are as follows:

- separate storage facility from working and living areas,
- follow label directions for storage,
- place a warning sign on entrances,
- tightly close containers,
- do not store pesticides with food, feed, fertilizer or seed,
- use the storage facility for any pesticides that are not currently in use,
- do not store personal protective equipment in the storage facility. Keep it nearby in case of an accident,
- store herbicides away from other pesticides,

- keep absorbent materials such as clay, kitty litter, sawdust, etc. handy in case of a spill, and
- keep an updated list of stored pesticides and inform the local fire department of the contents and location of the 'pesticide storage facility.'

8.4.6 Disposal of Unwanted Pesticides

Disposal of unwanted pesticides is a critical problem and has no simple solution. The best precaution against pesticide disposal is good planning.

Only purchase quantities of pesticides that you should be able to use up within two years.

Prepare the exact amount of spray mixture that you need. Accurate knowledge of field size and sprayer output will help avoid mixing excess spray material. If you end up with surplus mixture, avoid reapplying it to your crop as it may result in high pesticide residue levels. Instead, you could spray the headlands but be aware that high herbicide residues could affect future crops. Do not apply pesticides next to ditches or watercourses and wells, maintain a minimum 10 m (35 ft) pesticide free zone. When there is a need to dispose of excess spray mixture, use a carefully selected waste area. The waste area should be away from people, crops, watercourses, sewers and ditches and should not be on land subject to flooding. The soil at the waste area should be fine (e.g. clay) rather than coarse (e.g. sand) to prevent leaching into groundwater. Do not dump spray mixtures where you may dig a well, put up a building, or plant a crop in the future. See Section 8.4.4, Disposal of Pesticide Containers and Table 8.1.

Disposal of surplus mix must be a minimum of 200 m (660 ft) from surface water or wells. Pesticides may be disposed of by delivery to a private company set up to receive the product. It is likely that there will be a cost involved in dropping off this product.

One alternative could be to store pesticides until the Province of British Columbia has an approved disposal facility. A person not certified may be found in violation of the Waste Management Act if storing quantities of unregistered product or pesticides no approved listed for use in British Columbia.

If you have unwanted pesticides and need information, advice or assistance regarding disposal, contact the nearest office of the B.C. Ministry of Environment, Lands and Parks, Toxic Reduction Branch of the Environmental Waste Division.

8.4.7 Pesticide Spills on the Farm

Occasionally pesticide spills occur. If this happens here are a few requirements for cleaning and decontaminating the area:

- Contact the B.C. Ministry of Environment, Lands and Parks and Medical Health Officer and explain the circumstances surrounding the spill immediately.

- Prevent people and animals from being exposed to the pesticide and its fumes.

- For your own safety, tell someone that you are cleaning up a pesticide spill, where you will be and when you are expected to return.
- Put on protective equipment before cleaning up the spill. Rubber boots and gloves are necessary. Overalls, a respirator and eye protection should be worn for toxic and very toxic pesticides. Remember you are handling concentrated pesticides.
- Prevent the spread of the pesticide. Cover a liquid pesticide with soil, sawdust or any absorptive material.
- Ventilate the area.
- Once the liquid is absorbed into the material, remove the contaminated material to a safe place. Bury the contaminated material at least 50 cm (20 in) deep in an area that will not be cropped and is a minimum of 30 m (100 ft) from a watercourse. Also, avoid areas that can leach to groundwater or are subject to flooding.
- Decontaminate the surface. Check the label for specific directions. Many pesticides can be detoxified by washing the area with chlorine bleach and detergent. Take care to prevent the wash solution from spreading and contaminating a larger area.

If the spill occurs outside on the ground, cover with soil and allow the pesticide to soak into the ground. DO NOT use this as a method of disposing of excess amounts to pesticides. If the spill occurs beside a watercourse, remove the top layer of contaminated soil and bury it as in step 8.3.6.

Well contamination caused by chemical spills occurring during sprayer filling is a major concern. It is recommended that a contingency plan be in place to prevent this occurrence. A contingency plan should provide for:

- a berm around the well that will deflect surface spills away,
- a sprayer filling location sited at a lower elevation than the well,
- a siting of the filling location away from the well, e.g. 10 m (30 ft),
- standby equipment that includes absorptive material, shovel, etc.

8.5 FARM MEDICAL WASTES

The use of medication in poultry and livestock production is a common practice. There is a growing volume of spent medicines, empty containers and other disposable medical paraphernalia that must be disposed of in an environmentally acceptable manner.

Where incineration of this farm medical waste, in an **approved** facility (an incinerator designed to consume medical waste), is not available to the producer, the following will apply:

- disinfect needles, syringes and other paraphernalia prior to discarding by boiling for 5 minutes or soaking in disinfectant,
- needles and syringes must be 'rendered non-recognizable' following disinfection,
- needles must be 'ground-off' or otherwise destroyed to eliminate the chance of puncturing a trash handler,
- it is recommended that discarded farm medical waste that has the potential to puncture or cut, be packaged in a rigid container (plastic or equal) prior to discarding with household waste,
- medical supplies that have outlived their shelf life can be taken back to some suppliers, and

- contact the B.C. Ministry of Environment, Lands and Parks if quantities destined for disposal are in excess of 5 kg (10 lb) or 5 litres (1 gal).

8.6 PETROLEUM PRODUCTS

On farm receiving and dispensing sites for gasoline and diesel fuels are potential sources of environmental contamination. Fuel spills and disposal of used oils can be a major threat to soil and water quality. It takes very little product to have a detrimental effect on the receiving environment.

When handling, storing or disposing of petroleum products consider the following:

- fuel tanks must be equipped with an anti-siphoning device included in the tank discharge unless a self-closing nozzle is provided,
- drains must be lockable in the closed position,
- storage tanks must be constructed in accordance with accepted engineering practice, and may include a concrete, dyked facility,
- tanks must be located away from yard drains, etc.
- tanks should be set back 10 m (35 ft) from a watercourse or ditch,
- care must be taken when filling the tank to ensure no overflow,
- care must be taken when dispensing fuels to ensure no overflow occurs, and
- the tank should be protected from direct collision by farm vehicle.

For disposal of spent oils or used oils, the best alternative is to return the oil to the manufacturer for recycling. Under the Special Waste Regulations of the Ministry of Environment, Lands and Parks used oil is not allowed to be applied to roads as a dust suppressant.

APPENDIX A

BRITISH COLUMBIA MINISTRY OF AGRICULTURE, FISHERIES AND FOOD NON-REGULATORY ENVIRONMENTAL PROGRAMS

The B.C. Ministry of Agriculture, Fisheries and Food has four non-regulatory environmental programs consisting of Best Agricultural Waste Management Plans, Best Soil Management Plans, Nitrogen Behaviour Simulation Model, and ALDA and are outlined below.

1. Best Agricultural Waste Management Plans

Best Agricultural Waste Management Plans provide waste management recommendations to poultry producers who have pollution concerns caused by:

- manures (collection, storage or spreading),
- dead animals (disposal),
- poultry feed, or
- yard runoff (clean water running into farmyards, or manure running out of yards),

Best Agricultural Waste Management Plans are not intended to address pesticide pollution concerns.

Producers should contact their local agricultural office (see inside back cover for office closest to you) and discuss with the District Agriculturalist the need for a Best Agricultural Waste Management Plan. If a plan is required, a work request identifying the farm and problem is sent to the Soils and Engineering Branch. A person with professional qualifications in the field of environmental assessment and licensed to practice in British Columbia will visit the farm with the producer and jointly develop the Best Agricultural Waste Management Plan to address the identified or potential pollution problems.

The plan will consist of a written description of the: (1) present situation, (2) possible pollution problems, (3) suggestions for improvement. The Plan will include sketches if appropriate. The suggestions are grouped into three areas: (A) very important, (B) important, and (C) should be considered. The plan will also indicate works which require a professional engineer design.

When all the suggestions in the Best Agricultural Waste Management Plan are followed, the poultry producer's operation should be in compliance with all provincial and federal environmental laws and regulations, including the Code of Agricultural Practice for Waste Management.

2. Best Soil Management Plans

Best Soil Management Plans are intended to provide soil management recommendations for farms that have problems with:

- soil erosion,
- soil compaction,
- organic soil subsidence,
- soil structure deterioration,
- soil moisture deficit (where irrigation is not available), or
- soil acidity.

Best Soil Management Plans are not intended to address routine soil management concerns, such as soil fertility.

Soil management recommendations identified in the Best Soil Management Plans may involve capital items or works that would require professional expertise.

Those producers wishing to take part in the program should follow the same procedures used to obtain a Best Agricultural Waste Management Plan.

3. Nitrogen Behaviour Simulation Computer Model

The model simulates nitrogen behaviour from the time that it leaves the animal as manure until it enters the soil and is eventually taken up by a crop, lost to the environment or becomes a component of soil organic matter. The model consists of four parts: manure transformations during collection, storage and spreading; soil processes; crop growth; and water movement through the soil.

Four categories of input information are required from the user: manure type and characteristics, soil type, climatic parameters and crop type. This information is used by the model to predict the following: crop yield, crop nitrogen uptake, organic nitrogen mineralization, and nitrogen losses due to volatilization, leaching and denitrification.

The model can be used to assess manure management practices to determine effect on crop production and the potential for environmental contamination.

4. The ALDA Program

The ALDA Program (Agricultural Land Development Assistance Program) has provided low interest loans for on-farm capital improvements since the 1950's. Agricultural credit is available for a minimum project cost of $5,000 and to a maximum loan of $75,000 per farm operation. Loans are for a 15 year term and interest rates are at half of the bank prime rate on approved credit.

The ALDA program has been expanded to include loans for environmental initiatives and adoption of new technologies.

Application to the ALDA Program is made by contacting the District Agriculturist or District Horticulturist at your local B.C. Ministry of Agriculture, Fisheries and Food office. (See list inside back cover.)

A sustainable agriculture industry depends on the effective use of farming practices that maintain and enhance soil and water quality. Often, implementing certain sustainable farming practices are expensive.

There are many items that qualify for ALDA assistance. All manure storage facilities qualify. Under the Environmental Enhancement Section, a livestock producer can obtain financial assistance for an engineered manure storage facility (this includes the professional engineering or agrologist cost incurred) and all the capital items that have been identified as qualifying in a Best Agricultural Waste Management Plan or Best Soil Management Plan.

APPENDIX B

B.C. FEDERATION OF AGRICULTURE ENVIRONMENTAL PROGRAM

1. Agricultural Environmental Protection Council

Farm leadership is essential in dealing with soil, water and air degradation and the adoption of environmentally sustainable production practices. Research scientists, farm advisors, agri-business environmental experts and others are required to provide farmers with information, guidance and assistance. However, the change to environmentally sustainable agriculture can only be implemented by individual farmers on their own farms. In 1990, the B.C. Federation of Agriculture formed the Agricultural Environmental Protection Council to allow peer producers the opportunity to address the environmental problems for individual farmers prior to regulatory agencies forcing farmers to adopt corrective measures.

The Agricultural Environmental Protection Council (AEPC) has grown out of the Agricultural Environmental Service (AES) Program. The AES has its beginnings in the Poultry Sanitation Committee that was formed in the 1960's to respond to the industries nuisance and pollution complaints. The AES program was administered through the B.C. Federation of Agriculture (address on inside front cover) and handled complaints regarding nuisance of improper waste handling on beef, dairy, poultry and hog farms. Where the AES primarily handled nuisance complaints from the public, the AEPC will respond to pollution and nuisance concerns from both the public and government agencies and cover a much broader cross section of agriculture.

The aim of the AEPC is to set and maintain high environmental standards for participating commodities and to develop and monitor a program that will respond and resolve nuisance and pollution complaints against farms and ranches in British Columbia

The Agricultural Environmental Protection Council has representations from: the B.C. Federation of Agriculture; participating agricultural commodities; B.C. Ministry of Environment, Lands and Parks; and B.C. Ministry of Agriculture, Fisheries and Food. Agricultural commodities volunteer to participate in the AEPC and its peer inspection program.

Upon receipt of a complaint, the AEPC intends initiating the following process:

1) To contact the local peer inspector and have the complaint investigated within two weeks of receipt of the complaint, and to contact the complaintant within a day.

2) To have the local peer inspectors write an inspection report explaining what the environmental concern is (and if it is justified), what corrective measures are required, and a date by which the corrective measures should be installed and operating. This inspection report is sent within two weeks of the inspection to the AEPC to forward to the subject farm as well as the person complaining.

3) To contact local peer inspectors to do a follow up visit to the subject farm on or about the date that the corrective measures should have been installed. Depending upon pollution, this would be not more than six months after receiving the complaint.

4) The local peer inspectors will write a compliance report explaining if the corrective measures were all installed as outlined in the inspection report (see 2 above). If all the corrective measures are not installed the inspectors should try to find out why. This compliance report is sent within two weeks of the follow up visit to the farm complained against, the person complaining and to the AEPC.

5) Farmers who are still causing an environmental problem after going through steps 1 to 4 will be turned over to the appropriate government agency to be dealt with.

This process has been set up so that the bulk of farms that are farming in an environmentally sound manner or those that, after inspection, change to an environmentally acceptable method will not require regulating agencies' involvement. Only those farmers who choose to remain farming in an environmentally unacceptable manner will be turned over to the regulatory agencies.

This process also allows the AEPC to review all inspection and compliance reports to make sure all farms are treated fairly, and that inspectors are making reasonable suggestions.

As there is a need to respond to complaints in a timely manner there will be several inspectors for each commodity throughout the province.

Inspectors in each of the commodities will be trained and aware of the requirements and standards set out by the AEPC, including methods of reporting, how to get technical assistance to the farm, and when to involve a regulatory agency.

The **"Environmental Guidelines for Poultry Producers in British Columbia"** will be used as the standard by the poultry peer inspectors to determine compliance with the Code of Agricultural Practice for Waste Management.

The AEPC will review this process on a regular basis and take action to ensure a high agricultural waste management standard and environmentally responsible agricultural waste management practices are maintained on British Columbia's farms and ranches.

2. Federation Program Relationship to Environmental Agencies

The Agricultural Environmental Protection Council wishes to be the initial mechanism for resolving agricultural environmental complaints. See Table B.1 (in this Appendix) for the ways that a complaint might travel to the AEPC Program administrator.

There is nothing official to suggest that the AEPC must receive the first opportunity to solve the complaint. Providing AEPC can make sound resolutions and recommendations that result in addressing the complaint fully on the first inspection, the first opportunity to resolve the complaint should be with the AEPC. It must be pointed out that the B.C. Ministry of Environment, Lands and Parks and the Department of Fisheries and Oceans retain the right to prosecute at any time pollution

occurs, or if producers do not meet the Code of Agricultural Practice for Waste Management. Poultry producers are well advised to clean up existing agricultural waste problems before they become an issue.

Table B.1 Guideline to the Interrelationship of the Federation AEPC Program and Government Agencies

Type of Environmental Concerns	Severity of Issue	Who to Contact	Inspection & Recommendations	Re-Inspection for Compliance	For Non-Compliance Final Action
Pollution of Air or Water	Severe	MOE	MOE/AEPC	MOE	MOE
	Non-Severe	MOE	AEPC	AEPC	MOE
Pollution of Provincial Fish Habitat	Severe	MOE	MOE/AEPC	MOE	MOE
	Non-Severe	MOE	AEPC	AEPC	MOE
Pollution of Federal Fish Habitat	Severe	DFO	DFO/AEPC	DFO	DFO
	Non-Severe	DFO	AEPC	AEPC	DFO
Human/Public Health Implications	Severe	MOH	MOH/AEPC	MOH	MOH
	Non-Severe	MOH	AEPC	AEPC	MOH
Nuisance		AEPC	AEPC	AEPC	Local Government
Environmental Audit		MAFF	MAFF/BAWMP Consultant		

LEGEND:

AEPC	Agricultural Environmental Protection Council (B.C. Federation of Agriculture)
BAWMP	Best Agricultural Waste Management Plan (BCMAFF)
DFO	Department of Fisheries and Oceans
MAFF	B.C. Ministry of Agriculture, Fisheries and Food
MOE	B.C. Ministry of Environment, Lands and Parks
MOH	B.C. Ministry of Health

NOTE: The type of environmental concern may be of interest to more than one contact agency.

Table B.1 summarizes how the various agencies that are involved interrelate when addressing the various types of environmental concerns. Table B1 also contains a column showing the agency that will become involved when there is non-compliance with AEPC recommendations or if the recommendations do not solve the complaint.

The legislative authority for enforcing provincial environmental standards is the B.C. Ministry of Environment, Lands and Parks under the Waste Management Act, the Agricultural Waste Control Regulation and the Code of Agricultural Practice for Waste Management. The Federal Fisheries Act is enforced by the Department of Fisheries and Oceans.

APPENDIX C

AGRICULTURAL WASTE CONTROL REGULATION AND THE CODE OF AGRICULTURAL PRACTICE FOR WASTE MANAGEMENT

The Code of Agricultural Practice for Waste Management was drafted by the B.C. Ministry of Environment, Lands and Parks, Ministry of Agriculture, Fisheries and Food, the Federation of Agriculture, Department of Fisheries and Oceans (Federal) and local government representation.

AGRICULTURAL WASTE CONTROL REGULATION

Interpretation

1. In this regulation

"agricultural operation" means any agricultural operation or activity carried out on a farm including

(a) an operation or activity devoted to the production or keeping of livestock, poultry, farmed game, fur bearing animals, crops, grain, vegetables, milk, eggs, honey, mushrooms, horticultural products, tree fruits, berries, and

(b) the operation of machinery and equipment for agricultural waste management or application of fertilizers and soil conditioners;

"Code" means the *Code of Agricultural Practice for Waste Management April 1, 1992* attached to this regulation.

Exemptions

2. A person who carries out an agricultural operation in accordance with the Code is, for the purposes of carrying out that agricultural operation, exempt from section 3 (1.1) and (1.2) of the *Waste Management Act*.

CODE OF AGRICULTURAL PRACTICE FOR WASTE MANAGEMENT, April 1, 1992

PART 1

PURPOSE

Purpose

1. The purpose of this Code is to describe practices for using, storing and managing agricultural waste that will result in agricultural waste being handled in an environmentally sound manner.

PART 2

INTERPRETATION

Interpretation

2. (1) In this Code

"agricultural unit" means a live weight of 455 kg (1 000 lbs) of livestock, poultry or farmed game or any combination of them that equals 455 kg;

"agricultural waste" includes manure, used mushroom medium and agricultural vegetation waste;

"confined livestock area" means an outdoor, non-grazing area where livestock, poultry or farmed game is confined by fences, other structures or topography including feedlots, paddocks, corrals, exercise yards and holding areas, but not including a seasonal feeding area;

"farmed game" means any animal held under the authority of a licence under the *Game Farm Act*;

"feedlot" means a fenced area where livestock, poultry or farmed game is confined solely for the purpose of growing or finishing and are sustained by means other than grazing;

"field storage" means a temporary stock of agricultural waste ready to be drawn upon for use as a crop fertilizer or soil conditioner;

"grazing area" means a pasture or rangeland where livestock, poultry or farmed game is primarily sustained by direct consumption of feed growing on the area;

"groundwater" means water below the surface of the ground;

"manager" means a person employed by the Crown and designated in writing by the minister as a district director, a regional waste manager or an acting, assistant or deputy regional waste manager;

"mortalities" means livestock, poultry or farmed game that has died and that is unmarketable;

"mushroom medium" means a mixture that is composted and used as a medium for growing mushrooms;

"pollution" means the presence in the environment of substances or contaminants that substantially alter or impair the usefulness of the environment;

"precipitation" means precipitation as determined by the Canadian Atmospheric Environmental Service Reports of Environment Canada;

"seasonal feeding area" means an area

(a) used for forage or other crop production, and

(b) used seasonally for feeding livestock, poultry or farmed game that is primarily sustained by supplemental feed, but

(c) does not include a confined livestock area or grazing area;

"soilless medium" means a material that is manufactured for the growing of plants and may contain natural soils;

"solid agricultural waste" means agricultural waste that

(a) is 20% or more solid matter, and

(b) will not flow when piled;

"storage facility" includes a structure, reservoir, lagoon, cistern, gutter, tank or bermed area for containing agricultural waste prior to its use or disposal, but does not include a vehicle or any mobile equipment used for transportation or disposal of agricultural waste;

"watercourse" means a place that perennially or intermittently contains surface water, including a lake, river, creek, canal, spring, ravine, swamp, salt water marsh or bog, and including a drainage ditch leading into any of the foregoing;

"wood waste" includes hog fuel, mill ends, wood chips, bark and sawdust, but does not include demolition waste, construction waste, tree stumps, branches, logs or log ends.

(2) The definitions of the *Waste Management Act* apply to this Code.

PART 3

GENERAL

General

3. Agricultural wastes, wood waste and mortalities must be collected, stored, handled, used and disposed of in accordance with this Code and in a manner that prevents pollution.

PART 4

STORAGE AND USE OF AGRICULTURAL WASTE

Allowable storage

4. Agricultural waste may be stored on a farm only if the waste is produced or used on that farm.

Storage methods

5. When agricultural waste is stored, it must be stored

(a) in a storage facility,

(b) as field storage, or

(c) in the case of waste from fur bearing animals, under their outdoor pens.

Storage facility

6. A storage facility must

(a) be of sufficient capacity to store all the agricultural waste produced or used on the farm for the period of time needed to allow for

(i) the application of agricultural waste as a fertilizer or soil conditioner, or

(ii) the removal of agricultural waste,

(b) prevent the escape of any agricultural waste that causes pollution, and

(c) be maintained in a manner to prevent pollution.

Location of storage facility

7. (1) A storage facility must be located at least 15 m from any watercourse and 30 m from any source of water for domestic purposes.

(2) Subsection (1) does not apply to a storage facility existing prior to April 1, 1992 provided that a report

(a) demonstrating to the satisfaction of the manager that no pollution of any watercourse or domestic water supply is occurring from the storage facility, and

(b) produced by

(i) a person with professional qualifications in the field of environmental assessment and licensed to practice in British Columbia, or

(ii) staff of the Ministry of Agriculture, Fisheries and Food under a Best Agricultural Waste Management Plan

is made available to the manager within 12 months of his or her request.

Field storage

8. (1) Solid agricultural waste may be stored on a field for 2 weeks or less if the agricultural waste is

(a) used within 2 weeks, and

(b) stored in a manner that prevents the escape of agricultural waste that causes pollution.

(2) Solid agricultural waste may be stored on a field for more than 2 weeks if the agricultural waste is

(a) stored for no longer than 9 months,

(b) located at least 30 m from any watercourse or any source of water used for domestic purposes, and

(c) stored in a manner that prevents the escape of agricultural waste that causes pollution.

(3) Berms or other works must be constructed around a field storage area if this is necessary to prevent the escape of agricultural waste that causes pollution.

Rainy season field storage

9. In areas of the Province, including the Fraser Valley and Vancouver Island, that receive a total average precipitation greater than 600 mm (24 in) during the months of October to April inclusive, field stored solid agricultural wastes, except agricultural vegetation waste, must be covered from October 1 to April 1 inclusive to prevent the escape of agricultural waste that causes pollution.

Under pen storage

10. (1) Agricultural waste from fur bearing animals may be stored under their outdoor pens for up to 9 months if the storage area under the pens

(a) prevents the escape of any agricultural wastes that causes pollution, and

(b) is located at least 15 m from a watercourse and 30 m from any source of water used for domestic purposes.

(2) Subsection (1) (b) does not apply to a pen constructed prior to April 1, 1992 provided that a report

(a) demonstrating to the satisfaction of the manager that no pollution of any watercourse or domestic water supply is occurring from the under pen storage facility, and

(b) produced by

(i) a person with professional qualifications in the field of environmental assessment and licensed to practice in British Columbia, or

(ii) staff of the Ministry of Agriculture, Fisheries and Food under a Best Agricultural Waste Management Plan

is made available to the manager within 12 months of his or her request.

PART 5

APPLICATION AND COMPOSTING OF AGRICULTURAL WASTE

Discharge to water

11. Agricultural waste must not be directly discharged into a watercourse or groundwater.

Allowable application

12. Agricultural waste must be applied to land only as a fertilizer or a soil conditioner.

Prohibited application

13. Agricultural waste must not be applied to the land if, due to meteorological, topographical or soil conditions or the rate of application, runoff or the escape of agricultural waste causes pollution of a watercourse or groundwater.

Conditions unfavorable to application

14. Agricultural wastes must not be applied

(a) on frozen land,

(b) in diverting winds,

(c) on areas having standing water,

(d) on saturated soils, or

(e) at rates of application that exceed the amount required for crop growth,

if runoff or escape of agricultural waste causes pollution of a watercourse or groundwater, or goes beyond the farm boundary.

Composting

15. Agricultural waste may be composted on a farm if

(a) the agricultural waste being composted consists only of agricultural waste

(i) produced on that farm, or

(ii) produced elsewhere but being composted for use on that farm only,

(b) the composting site is located at least 15 m from a watercourse and 30 m from any source of water used for domestic purposes, and

(c) the agricultural waste is composted in a manner that does not cause pollution.

Composting for mushroom medium

16. (1) Composting agricultural waste for the production of mushroom medium on a farm is allowed if

(a) the mushroom medium produced is used only on that farm,

(b) the composting site is located at least 15 m from a watercourse and 30 m from any source of water used for domestic purposes, and

(c) the medium is composted in a manner that does not cause pollution.

(2) Subsection (1) (a) and (b) does not apply to a composting operation and site existing prior to April 1, 1992 provided that a report

(a) demonstrating to the satisfaction of the manager that no pollution of any watercourse or domestic water supply is occurring from the composting operation and site, and

(b) produced by

(i) a person with professional qualifications in the field of environmental assessment and licensed to practice in British Columbia, or

(ii) staff of the Ministry of Agriculture, Fisheries and Food under a Best Agricultural Waste Management Plan

is completed by April 1, 1993 and is made available to the manager at his or her request.

PART 6

AGRICULTURAL EMISSIONS

Emissions

17. Emissions from forced air ventilation systems used on a farm must not cause pollution.

Wood fired boilers

18. Emissions from a wood fired boiler must not exceed 180 mg per cubic metre of particulate matter and 20% opacity, except that

(a) for a permanent wood fired boiler installed before April 1, 1992 and not operating under a waste management permit, emissions must not exceed 230 mg per cubic metre of particulate matter and 20% opacity, and

(b) for a permanent wood fired boiler installed before April 1, 1992 and operating under a waste management permit, the emission levels under that permit apply unless those levels are higher than the levels specified in (a).

Odours not prohibited

19. Nothing in this Code is intended to prohibit various odours from agricultural operations or activities on a farm, providing such operations or activities are carried out in accordance with this Code.

PART 7

STORAGE AND USE OF WOOD WASTE

Allowable use

20. Wood waste may only be used for

(a) plant mulch, soil conditioner, ground cover, on-farm access ways, livestock bedding and areas where livestock, poultry or farmed game are confined or exercised,

(b) berms for cranberry production, or

(c) fuel for wood fired boilers.

Storage

21. Wood waste stored and used on a farm must be handled so as to prevent any escape of

(a) particulate or solid matter from the wood waste into the air, or

(b) particulate or solid matter or leachate from the wood waste into any watercourse or groundwater

that causes pollution.

Prohibited use

22. Wood waste used on the farm must not be used

(a) for landfill, and

(b) on sites within 30 m of any source of water used for domestic purposes with the exception of existing sites under use prior to April 1, 1992, provided that this use is not causing pollution.

PART 8

ON-FARM DISPOSAL OF MORTALITIES

Burial and incineration

23. (1) Mortalities may be disposed of on-farm by burial or incineration if

(a) the mortalities are livestock, poultry or farmed game disposed of on the farm where they died,

(b) the disposal does not cause pollution,

(c) where disposal is to land, the burial pits are covered, located at least 30 m from any source of water used for domestic purposes and constructed to prevent the escape of any agricultural waste that causes pollution, and

(d) where disposal is by incineration, the emissions from an incinerator do not exceed 180 mg per cubic metre of particulate matter and 20% opacity, except that

(i) for a permanent incinerator installed before April 1, 1992 and not operating under a waste management permit, emissions must not exceed 230 mg per cubic metre of particulate matter and 20% opacity, and

(ii) for a permanent incinerator installed before April 1, 1992 and operating under a waste management permit, the emission levels required by that permit apply unless those levels exceed the levels specified in (i).

Composting

24. Mortalities may be composted on-farm if

(a) the mortalities are composted on the farm where they died,

(b) the composting site is located at least 15 m from a watercourse and 30 m from any source of water used for domestic purposes, and

(c) the composting does not cause pollution.

PART 9

FEEDING AREAS AND ACCESS TO WATER

Grazing areas

25. Livestock, poultry or farmed game feeding within a grazing area may have access to watercourses, provided that the agricultural waste produced by that livestock, poultry or farmed game does not cause pollution.

Seasonal feeding areas

26. (1) A seasonal feeding area for livestock, poultry or farmed game must

(a) be operated in a way that does not cause pollution, and

(b) have berms where necessary to prevent agricultural waste runoff from causing pollution.

(2) Locations for feeding livestock, poultry or farmed game within a seasonal feeding area, including locations for movable feed bunks, must

(a) be at least 30 m from a high tide watermark, a watercourse or the bank of a watercourse, unless written permission has been obtained from the manager for a closer location, and

(b) be distributed throughout the area to ensure that manure from the feeding of livestock, poultry or farmed game is spread as a fertilizer or soil conditioner and that no accumulation of manure causes pollution.

(3) Where permanent feed bunks are used within a seasonal feeding area, written permission for the location of the bunks must be obtained from the manager.

Seasonal area access

27. Livestock, poultry or farmed game in a seasonal feeding area may have access to watercourses provided that

(a) the feeding of livestock, poultry or farmed game is in accordance with section 26, and

(b) the access is located and maintained as necessary to prevent pollution.

Confined area access

28. Livestock, poultry or farmed game in a confined livestock area may not have access to a watercourse, with the exception of a holding area on rangeland where

(a) livestock is held no longer than 72 hours,

(b) the watercourse is not a source of water used for domestic purposes at any location downstream from the confined livestock area, and

(c) the access is located and maintained as necessary to prevent pollution.

Confined area operation

29. (1) Confined livestock areas must be operated in a way that does not cause pollution.

(2) If there are more than 10 agricultural units in a confined livestock area or areas within the same drainage basin then the area or areas must be located at least 30 m from a high tide watermark, a watercourse, the bank of a watercourse or any source of water used for domestic purposes.

(3) Subsection (2) does not apply to a permanent confined livestock area constructed prior to April 1, 1992 provided that a report

(a) demonstrating to the satisfaction of the manager that no pollution of any watercourse or domestic water supply is occurring from the permanent confined livestock area, and

(b) produced by

(i) a person with professional qualifications in the field of environmental assessment and licensed to practice in British Columbia, or

(ii) staff of the Ministry of Agriculture, Fisheries and Food under a Best Agricultural Waste Management Plan

is completed by April 1, 1993 and is made available to the manager at his or her request.

PART 10

USE AND STORAGE OF AGRICULTURAL PRODUCTS

Agricultural products

30. Agricultural products such as livestock, poultry, farmed game, fur bearing animals, animal and poultry feeds, forage silage, forage crops, vegetables and chemical fertilizers must be managed, used and stored in a manner that prevents the escape of agricultural waste that causes pollution.

Mushroom or soilless medium

31. Raw materials for making products such as mushroom medium or soilless medium must be used and stored in a manner that prevents the escape of agricultural waste that causes pollution.

APPENDIX D

LAND APPLICATION OF POULTRY MANURE ASSUMPTIONS

1. Nitrogen in Manure

0.71 kg nitrogen excreted by a layer place each year
0.34 kg nitrogen excreted by a broiler place each year
0.77 kg nitrogen excreted by a turkey place each year
0.32 kg nitrogen excreted by a pullet place each year.

2. Nitrogen Losses during Storage

57% of excreted nitrogen remains in layer manure when spread to land
77% of excreted nitrogen remains in broiler, turkey and pullet manure when spread to land.

3. Nitrogen Losses during Spreading

Manure incorporated into the soil within 24 hours.
90% of applied manure nitrogen is incorporated into the soil.

4. Manure Application to Grassland

Although sod injection of manure has been used with mixed success elsewhere, it is highly unlikely that it will become a common practice in British Columbia in the near term. Therefore, the assumption is made that manure applications to grassland are not incorporated (although it is recognized that irrigation following manure application can substantially reduce nitrogen losses). Because of higher nitrogen losses from unincorporated manure, the Table 6.1 values for grass have been increased by 1.25. Grassland means grassland that is cropped with no livestock grazing the grass. Where grazing occurs, adjustment in the volume of applied wastes is required as the grazing stock have added wastes over the time that they have been in the field.

5. Nitrogen Supply from the Soil

Table 6.1 assumes crops are being produced on soils containing >10% organic matter. If soils contain 5-10% organic matter, rate of application can be increased by a factor of 1.2, and if <5% organic matter rates can be increased by 1.4.

6. Nitrogen Removal

Nitrogen removal values are based on the nitrogen content of high yields of the various crops (these values assume that most common practices concerning the removal from the land of the non-harvested portion of the crops). For example, it is assumed that 100% of the above ground portion of a silage corn crop is removed. On the other hand, for broccoli, it is assumed that the non-harvested, above ground portion of the crop is left in the field and eventually incorporated into the soil. The nitrogen in non-harvested portions of crops is assumed to contribute to the soil's supply of nitrogen for subsequent crops. Approximately 50% of the nitrogen in the refuse portion is assumed to be available to subsequent crops.

7. Routine Use of Manure

When manure is applied regularly for a number of years, nitrogen in the organic portion of the manure is released over time to subsequent crops. The values in Table 6.1 assume routine, annual use of manure (20% of the nitrogen supply is assumed to come from previous manure applications). If, however, manure use is infrequently (1 or 2 applications over a 5 or more year period), the rate can be increased without undo environmental hazard (the adjustment factor chosen is 1.1 for layer manure and 1.25 for all other poultry manure).

APPENDIX E

REFERENCE MATERIAL FOR POULTRY PRODUCERS

Publication/Available From

1. Canadian Farm Building Code/The Secretary, Associate Committee on the National Building Code, National Research Council, Ottawa, Ontario, Canada, K1A 0R6.
2. Canadian Farm Building Handbook/Canadian Government Publishing Centre, Supply and Services Canada, Hull, Quebec, Canada, K1A 0S9.
3. Handbook for Pesticide Applicators/B.C. Ministry of Environment, Lands and Parks.
4. Manure Management Guidelines/B.C. Ministry of Agriculture, Fisheries and Food.
5. Planning Grain Feed Handling (MWPS-13) ISBN0-89373-007-6/Iowa State University, Ames, Iowa, U.S.A. 50011.
6. Poultry Building System Handbook/B.C. Ministry of Agriculture, Fisheries and Food offices listed inside back cover.
7. Poultry Carcass Composting/ B.C. Ministry of Agriculture, Fisheries and Food.
8. Recommended Code of Practice for the Care and Handling of Poultry from Hatchery to Processing Plant, Publication 1757/E/Communications Branch, Agriculture Canada, Ottawa, Ontario, Canada, K1A 0C7.
9. Soil Management Handbook for the Lower Fraser Valley.
10. Soil Management Handbook for the Okanagan and Similkameen Valleys.
11. Ventilation Handbook/B.C. Ministry of Agriculture, Fisheries and Food.
12. Guidelines to Prevent Damage to Fish and Fish Habitat from the Transportation, Storage Use and Disposal of Wood Waste in B.C./Department of Fisheries and Oceans, Department of Environment.
13. B.C. Ministry of Agriculture, Fisheries and Food, Soils and Engineering Branch, Publication List, Factsheets of interest include:
    - 340.000-1 Poultry Housing
    - 384.200-2 Rodent & Bird Control in Farm Buildings
    - 384.200-4 Rodent Control on Agricultural Land in B.C.
    - 200.310-1 Pesticide Safety for Field Workers
    - 234.005-1 Suggestions for Field Sprayer Operation and Maintenance
    - 380.750-1 Manure Gases
    - 200.308-1 Beware of On-Farm Manure Storage Hazards
    - 306.407-1 Manure Pit Ventilation in Confinement Livestock Buildings
    - 380.750-2 Manure Gas
    - 650.000-1 Land Application of Animal Manure
    - 631.001-1 Safe and Efficient Nitrogen Use
    - 652.200-3 Liquid Manure (Slurry) vs Solid Manure in Crop Production
    - 502.000-5 Canada's Fish Habitat Law
    - 502.000-6 Stream Care (AC)

APPENDIX F
GLOSSARY OF TERMS

Bird Place: The average number of birds on the farm.

Code of Agricultural Practice for Waste Management: Attached to the Regulations of the Waste Management Act to outline environmentally sound agricultural waste practices (see Appendix C).

Contaminants: Substances that in sufficient amounts will pollute.

Denitrification: The biochemical reductions of nitrate or nitrite to gaseous nitrogen, either as molecular nitrogen or as an oxide of nitrogen.

Environment: Environment means the air, land and water under which man, animals and plants live or are developed.

Groundwater: Water below the surface of the ground.

Impervious: Resistant to penetration by liquid, and will have an infiltration rate less than 10^{-9}m/sec.

Leaching: The removal of materials in solution from the soil by percolating waters.

Litter: A mixture of bedding used in poultry houses and poultry manure.

Mineralization: The conversion of an element from an organic form to an inorganic state as a result of microbial decomposition.

Pollution: The presence in the environment of substances or contaminants that substantially alter or impair the usefulness of the environment.

Volatilization: Transformation of compounds from the liquid phase to the gas phase and then released to the atmosphere.

Watercourse: A water course perennially or intermittently containing water, including a lake, river, creek, spring, ravine, swamp, salt water marsh, bog, and drainage ditch leading into any of the foregoing.

Waste Management Act: B.C. Act regulating waste disposal, administered by the Ministry of Environment, Lands and Parks.

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